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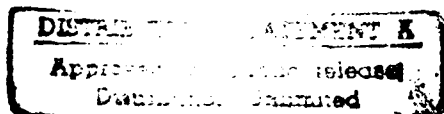
**National Science Resources Center Project
to Improve Science Teaching in Elementary Schools
with Special Emphasis on
Department Of Defense Dependents Schools and Other Schools
Serving Children of Military Personnel**

Final Report

October 1992

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**Submitted to the
U.S. Department of Defense**



**National Science Resources Center
National Academy of Sciences-Smithsonian Institution**

**Arts & Industries Building, Room 1201
Smithsonian Institution
Washington, DC 20560
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INTRODUCTION

Since 1987, the United States Department of Defense (DOD) provided support to the National Science Resources Center (NSRC) for a special Secretary of Defense (SECDEF) project targeted at improving the teaching of science in our nation's schools. The goals established for this project included:

- 1) identifying school systems with exemplary elementary science programs that could serve as models for other school districts;
- 2) forming a network of people and institutions to facilitate the sharing of ideas and resources for improving science teaching in elementary schools;
- 3) assessing the needs of school districts;
- 4) developing and maintaining a collection and information database of effective elementary science teaching materials to serve as resources for school systems;
- 5) developing and publishing an annotated resource guide of effective elementary science teaching resources;
- 6) developing and disseminating a set of hands-on elementary science teaching units for use in grades one through six;
- 7) providing a program of leadership development activities for educators and scientists to bring about reform in science education in their local communities;
- 8) disseminating information about effective teaching resources, sources of expertise, and program improvement strategies to teachers and school system administrators; and
- 9) providing technical assistance to local school districts that are working to develop and sustain effective hands-on science programs.

The project plan was based on a review of the research identifying the problems and needs related to K-12 science education today; a study of DOD precollege science education programs; research findings concerning the content and organization of effective science instruction; theories of organizational change; an understanding of the context in which organizational change must occur in the schools; and the experience the NSRC has gained in bringing about reforms in science education. The project plan was also based on discussions with hundreds of teachers, scientists, science educators, school system administrators, and other educational leaders.

The plan of operation for the project included consultation with the NSRC Advisory Board, and a comprehensive program of activities designed to reform science education. A list of the NSRC Advisory Board along with the NSRC brochure is contained in Appendix A.

The design of the plan paid special attention to the following issues that recent studies of precollege science education have identified:

- Reform efforts need to focus on the learning needs of all children, paying special attention to the needs of under-represented minorities and the handicapped;
- Reform efforts should be based on learning principles that derive from research and from well-tested experience;
- Reform efforts need to be systemic and comprehensive, dealing with all components and levels of the educational system;
- To bring about significant change in the schools, reform efforts need to be collaborative, involving school board members, superintendents of schools, principals, parent groups, university faculty, and

leaders from business and industry, as well as teachers and science educators; and

- To be successful, sustained reform efforts are needed, efforts that continue to operate over a decade or longer.

In all of the project activities, participation by DODDS and by other school systems serving children of military personnel in the United States was given priority.

The project was directed by the National Science Resources Center, (NSRC), which is operated jointly by the National Academy of Sciences and the Smithsonian Institution. The resources and support of both of these institutions provided the NSRC with a unique capacity to marshall the energies of leaders in science, education, and industry across the country, and enabled them to bring about reforms in science education.

ACCOMPLISHMENTS

Based on research and a well-designed plan of action, the NSRC initiated the special Secretary of Defense project to improve science teaching in elementary schools, with special emphasis on DODDS and other schools serving children of military personnel in FY 1987. During the past five years, the NSRC has accomplished the following:

I. Studied DOD Precollege Science and Mathematics Education Programs

During the first year of the project, the NSRC interviewed representatives and reviewed the materials produced by the following DOD programs that support the improvement of precollege science and mathematics education:

- DOD Apprenticeship Programs
- DOD Teacher Internship Programs
- DOD Partnership Programs
- DOD Dependents Schools
- U.S. Army National Science Center for Communications and Electronics (Fort Gordon, Georgia)
- The "Second Career" joint initiative by the U.S. Secretary of Defense and the U.S. Secretary of Education to encourage retired military personnel to become teachers and administrators

In carrying out this study, the NSRC exchanged materials and established links with personnel coordinating the above-named DOD programs. The DOD personnel interviewed were provided with information about the National Science Resources Center and were

invited to identify ways in which the NSRC might assist them in achieving program goals. The NSRC submitted a report of its findings and recommendations to DOD in October 1987. This report recommended that the Department of Defense expand the focus of its science and math education programs to include more emphasis at the elementary school level, in order to prepare and motivate children to take additional science and math courses in secondary school.

II. Designed a Comprehensive Four-Year Program of Activities to Improve the Teaching of Science in Elementary Schools throughout the Nation and Overseas

The results of the study described above led the NSRC to design a four-year program of activities to improve the teaching of science in elementary schools throughout the nation and overseas. The project was designed to develop and disseminate quality science resource materials and to organize a program of leadership development and other outreach activities to help school districts improve their elementary science programs. The project activities included strategies to build on and extend the NSRC's current links with DODDS and other schools serving children of military personnel, as well as other DOD-sponsored programs supporting the improvement of precollege science and mathematics education.

III. Implemented the Program of Activities to Improve the Teaching of Science in Elementary Schools throughout the Nation and Overseas

Identified School Systems with Exemplary Elementary Science Programs. The NSRC initiated activities to improve science teaching in elementary schools by first identifying school systems with exemplary elementary school science programs. The

districts served as sources of expertise, curriculum resources, and practical experience for DODDS and other school systems working to incorporate hands-on science programs into their elementary school curricula. The school systems with exemplary elementary science programs identified by the NSRC are listed in Table 1. The criteria used to identify these exemplary elementary science programs were based on those developed by Project Synthesis (Harms and Yager, 1981) and are summarized below.

- The development of the young child's intellect should be the major focus of elementary science instruction, rather than the development of detailed concepts in preparation for secondary school science.
- The science program should excite children's curiosity, build their interest in the world, and provide them with opportunities to practice the methods of science.
- Science process skills should be developed through experiences with phenomena that are observed, described, compared, and analyzed.
- The elementary science curriculum should emphasize the development of problem-solving skills; address important issues involving science and society; include the study of a variety of topics in the life, earth, and physical sciences; and develop an awareness of career opportunities in science.
- The elementary science program should provide frequent opportunities for students to discuss their observations and to debate the alternative solutions to problems.
- All children should have equal access to science instructional resources from teachers who have sufficient experience and knowledge to be confident about teaching science.

Table 1**School Districts With
Exemplary Elementary Science Programs**

School District	Elementary schools	Elementary teachers	Elementary students
Anchorage City Schools Anchorage, Alaska	54	1,116	20,501
Fairfax County Public Schools Fairfax, Virginia	120	3,249	51,627
Highline School District Seattle, Washington	21	261	8,549
Jefferson County Public Schools Lakewood, Colorado	80	2,070	39,784
Mesa Unified School District Mesa, Arizona	39	1,524	35,017
Milwaukee City Schools Milwaukee, Wisconsin	104	2,850	54,924
Monroe 2-Orleans Counties Board of Cooperative Education Services Spencerport, New York	407	1,116	103,125
Multnomah County Education Service District Portland, Oregon	103	2,242	49,000
Schaumburg School District Schaumburg, Illinois	20	449	11,595
School District of Philadelphia Philadelphia, Pennsylvania	172	5,033	106,357
TOTAL	1,120	19,910	480,479

- Teachers should exhibit an understanding of the stages of cognitive development in children and should demonstrate the ability to use teaching strategies that are appropriate to these stages.
- School district policy should provide for an adequate amount of time dedicated to the teaching of science in the elementary school curriculum.
- The school district should provide teachers with sufficient science apparatus to enable each child to work with concrete materials, and should develop an effective logistical system for supplying science apparatus and materials to teachers.

The NSRC will use the above criteria to identify additional school districts with exemplary elementary science programs following the completion of the project.

Created A Resource-Sharing Network of People and Organizations. During the past five years, the NSRC developed and maintained an active, nationwide network of educators and scientists. This network has functioned as the NSRC's link to individuals and organizations that are working to improve the teaching of science in the nation's schools. Through the NSRC Network, sources of expertise, resource materials, and program improvement strategies have been identified and information about them disseminated. The Network is composed of teachers and administrators from school districts with exemplary elementary science programs, and those that are just beginning to develop hands-on elementary science programs, as well as scientists, science educators, corporate leaders, school board members, government officials, PTA representatives, and other community representatives who are involved in activities to support the improvement of K-12 science education in the schools.

The NSRC computerized database of network members currently contains approximately 16,000 people. Individuals and organizations will continue to be added to the database as they are referred to the NSRC or as they respond to publicity about NSRC activities. Names currently in the NSRC Elementary Science Network may be obtained by DOD upon request.

Assessed Needs of School Systems. In 1986, the NSRC held the National Conference on the Teaching of Science in Elementary Schools at the National Academy of Sciences and the Smithsonian Institution. In attendance were more than one hundred teachers, science educators, and scientists who exchanged views on elementary science education. Over a three-day period, participants reviewed the state of science teaching in the nation's elementary schools, heard reports from science supervisors and other school system personnel that had implemented exemplary elementary science programs, and made recommendations to guide future efforts. Participants included Dale Hunter, former Chief of the Curriculum Branch of the Education Division of DODDS, and Barbara Clark, former Science Coordinator, Curriculum Branch, Education Division of DODDS.

The recommendations of needs that emerged from this conference were published in a brochure, "Science for Children: An Agenda for Action." These recommendations were disseminated in 1989 to the 16,000 superintendents of schools, the 1,000 members of the National Science Supervisors Association, the 88 members of the Council of State Science Supervisors, and the 10,000 members of the NSRC Elementary Science Network, which included all DODDS elementary schools and science coordinators. A copy of the brochure which was submitted to DOD in October 1989 is enclosed in Appendix B.

After this conference, the NSRC continued its assessment of school district needs related to science education by holding

discussions with scientists, teachers, school system science supervisors, principals, superintendents of schools, PTA presidents, science museum educators, business leaders, and representatives from scientific and professional organizations. These discussions included administrators from many large urban school districts and the science coordinators from each of the five regions - DODDS Atlantic, DODDS Germany, DODDS Mediterranean, DODDS Pacific, and DODDS Panama. From these discussions, the NSRC obtained an understanding of the special needs of DODDS, as well as the special problems of large urban school systems.

From these discussions, the NSRC identified elementary science materials that had been used successfully by large numbers of elementary school teachers; designs for effective teacher in-service education programs; effective materials support systems that supply elementary school teachers with science equipment and materials; and sources of assistance and expertise for improving science teaching in elementary schools.

As a result of these contacts, ongoing communications were facilitated. The staff from these school systems have communicated frequently with the NSRC staff and with other members of the NSRC Network to obtain suggestions for improving their elementary science programs.

Developed and Disseminated NSRC Hands-on Elementary Science Teaching Units. In response to school district needs for effective hands-on science curriculum units, the NSRC initiated the development of hands-on elementary science teaching units for use by elementary school children and teachers in grades one through six in 1988. Developed in cooperation with school districts across the country, the curriculum units involve children in hands-on investigations of scientific phenomena that enable them to learn science by doing science.

These modular eight-week units focus on important, age-appropriate topics in the life, physical, and earth sciences and technology, while simultaneously developing their critical-thinking and problem-solving skills. The units are designed to make science instruction more meaningful to children and more manageable for elementary school teachers. The units also link science with other curriculum areas, including mathematics, language arts, social studies, and art. In addition, the elementary science teaching units utilize kits of inexpensive equipment and materials that school systems can easily assemble and maintain. Additional information about the units can be found in Appendix C.

The science activities generated at the NSRC's 1987 Elementary Science Workshop produced ideas for the units to be developed by the project (See list of participating school districts on Table 2 on the next page). Using these ideas and additional research, the staff began work in the NSRC laboratory, where materials were investigated and outlines for unit lessons were prepared.

During this phase of the unit development process, the research associates reviewed the teaching resources and literature related to the topic under development. A brainstorming session was conducted with master elementary school teachers and scientists to generate innovative ideas for hands-on science activities. The proposed activities were discussed with teachers and science coordinators from districts with exemplary elementary science programs. Using this information and the results of experimentation in the NSRC laboratory, the unit development team then developed an outline for the unit's content and activities.

Table 2

1987 National Science Resources Center Elementary Science Workshop

Participating School Districts

School District	Elementary schools	Elementary teachers	Elementary students
Anchorage City Schools Anchorage, Alaska	54	1,116	20,501
Baltimore City Public Schools Baltimore, Maryland	120	2,862	56,674
Department of Defense Dependents Schools (DoDDS-Germany Region)	105	NA	49,098
District of Columbia Public Schools Washington, DC	120	3,291	50,239
Fairfax County Public Schools Fairfax, Virginia	120	3,249	51,627
Highline School District Seattle, Washington	21	261	8,549
Jefferson County Public Schools Lakewood, Colorado	80	2,070	39,784
Kalamazoo Science and Mathematics Center, Kalamazoo, Michigan	63	828	18,937
Mesa Unified School District Mesa, Arizona	39	1,524	35,017
Multnomah County Education Service District Portland, Oregon	103	2,242	43,903
New York City Public Schools, District 3, New York, New York	17	191	8,749
Schaumburg School District Schaumburg, Illinois	20	449	11,676
School District of Philadelphia Philadelphia, Pennsylvania	172	5,033	106,357
TOTAL	1,034	23,116	507,062

To ensure that the materials were effective for children and teachers in actual classroom settings, particularly minority children in inner city schools, the unit development process included two phases of testing with students and teachers in classrooms across the country--trial teaching and national field testing. The units were first trial taught with children in the District of Columbia Public Schools. The staff used the information obtained from the trial-teaching process to prepare a field-test version of the teacher's guides, and student activity books for each of the units.

Following preparation of the field-test edition of the materials, each unit was then tested with elementary school children in different school districts across the country. The sites were selected to ensure that a wide variety of school settings and cultural, ethnic, and socioeconomic backgrounds were represented. Those districts that were field test sites from 1989-1992 are noted on Table 3 on page 14. The ethnic composition of these school districts is summarized in Table 4 on pages 15 and 16.

A coordinator was selected for each field-test site. This individual, typically the science coordinator for the district, recruited elementary school teachers to field-test the materials, conducted a workshop for these teachers, and organized a follow-up discussion session with them.

To prepare the field-test teachers for this phase, they were sent the necessary materials--the teacher's guide, a set of the student activity books, a set of the science readers, and a kit of the science materials needed to teach the unit. After participating in a workshop to introduce them to the unit, the field-test teachers spent six to eight weeks using the materials with their students.

Table 3

Science and Technology for Children 1989-1992 Field-testing Sites

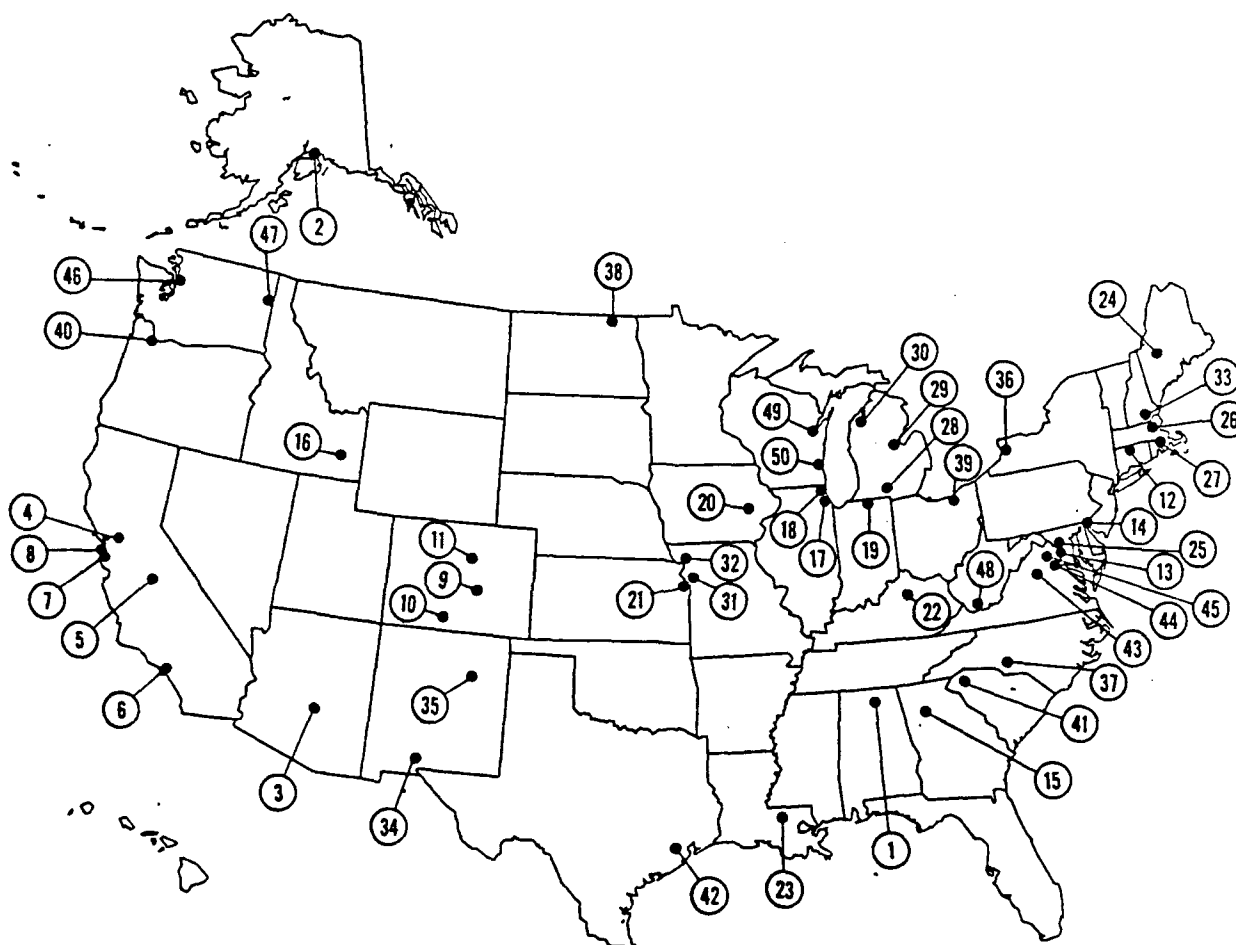


Table 4

**Science and Technology for Children:
Ethnic Composition and Student Enrollment of
1989-1992 Field-testing Sites**

School District	Percentage of enrollment						Actual enrollment	
	American Indian	Asian or Pacific Islander	Hispanic	Black, not Hispanic origin	White, not Hispanic origin	Other	Elementary students	Total students
1. Huntsville City School System, Huntsville, AL	0	0	0	34	66	0	12,401	24,338
2. Anchorage City Schools, Anchorage, AK	9.6	5.9	3.3	8.1	73.1	0	21,402	46,715
3. Mesa Unified School District, Mesa, AZ	3	2	10	2	83	0	35,017	61,839
4. Antioch Unified School District, Antioch, CA	1.1	5.8	17	3.5	72.6	0	8,211	13,738
5. Fresno Unified School District, Fresno, CA	2	20	36	10	32	0	44,873	72,000
6. Los Angeles Unified School District/USC/Los Angeles, CA	3	5.6	64.4	14.8	13.1	1.9	347,607	790,523
7. Redwood City/Menlo Park School Districts, San Mateo, CA	3	5.7	41.8	4.8	47.4	0	7,740	9,764
8. San Francisco Unified School District, San Francisco, CA	<1	47	19	19	14	0	29,053	62,345
9. Academy School District 20, Colorado Springs, CO	.7	2.2	3.5	3.3	90.3	0	5,740	12,381
10. Alamosa School District RE-11J, Alamosa, CO	0	.5	47	.5	52	0	1,275	2,536
11. Jefferson County Public Schools, Lakewood, CO	.6	2.6	7.7	.9	87	0	46,453	81,880
12. Hartford Public Schools, Hartford, CT	.1	1.4	43.9	45.3	9.4	0	16,237	25,015
13. District of Columbia Public Schools, Washington, DC	<1	<1	4	91	4	0	51,174	87,700
14. Christina School District, Newark, DE	1	1	3	23	72	0	10,000	16,500
15. Fulton County School District, Atlanta, GA	.06	2.8	1.48	43.2	51.9	.03	23,415	46,989
16. Idaho School District 25, Pocatello, ID	<1	<1	<1	1	98	0	7,318	13,802
17. Consolidated School District 54, Schaumburg, IL	<1	9	3	5	83	0	16,780	16,780
18. Palatine Public Schools District 15, Palatine, IL	<1	6	9	3	82	0	7,018	10,424
19. Elkhart Community Schools, Elkhart, IN	<1	1	2	16	81	0	6,446	11,175
20. Iowa City Community School District, Iowa City, IA	<1	4.6	2.2	4.2	88.6	0	5,641	9,690
21. Unified School District 500, Kansas City, KS	<1	1.9	8.5	50.5	38.9	0	11,134	22,011
22. Fayette County Public Schools, Lexington, KY	<1	1.5	<1	22.7	74.5	0	16,480	32,150
23. Iberville/West Baton Rouge Parish School Districts, Port Allen, LA	0	.001	.001	60	40	0	4,823	9,141
24. Maine School Administrative District 58, Kingfield, ME	0	0	0	1	99	0	787	1,150
25. Montgomery County Public Schools, Rockville, MD	<1	12	8	16	63	0	59,367	107,783
26. Cambridge Public Schools, Cambridge, MA	0	8	14	31	46	0	5,586	7,709
27. Fall River Public Schools, Fall River, MA	<1	3.3	1.9	2.3	92.3	0	6,950	12,473
28. Battle Creek Area Schools, Battle Creek, MI	<1	<1	2	14	83	0	15,050	26,852
29. Midland Public Schools, Midland, MI	<1	2	1	2	94	0	4,568	8,547
30. Traverse City Public Schools, Traverse City, MI	1	<1	<1	<1	97	0	5,991	10,261
31. The School District of Kansas City, Kansas City, MO	<1	1	4	69	25	0	18,896	34,348
32. St. Joseph School District, St. Joseph, MO	0	0	1	5	94	0	6,941	12,467
33. Nashua School District, Nashua, NH	<1	2.5	4.6	2.4	90.4	0	7,117	11,884
34. Las Cruces Public Schools District 2, Las Cruces, NM	1	0	54	1	44	0	9,100	18,100
35. Santa Rosa Consolidated Schools No. 8, Santa Rosa, NM	<1	<1	92	<1	7	0	518	825
36. Buffalo Public Schools, Buffalo, NY	1.2	1.1	8.7	48.7	39.9	0	29,602	48,252

School District	Percentage of enrollment						Actual enrollment	
	American Indian	Asian or Pacific Islander	Hispanic	Black, not Hispanic origin	White, not Hispanic origin	Other	Elementary students	Total students
37. Charlotte Mecklenburg Schools, Charlotte, NC	<1	2	<1	39	59	0	41,142	74,595
38. Turtle Mountain Schools, Belcourt, ND	97	0	0	0	2	0	1,691	2,193
39. Cleveland Public Schools, Cleveland, OH	<1	1	5	70	24	0	42,322	72,116
40. Multnomah County Education Service District, Portland, OR	2	6	3	10	79	0	50,000	90,000
41. Greenville County School District, Greenville, SC	<1	<1	<1	26	72	0	26,189	53,049
42. Fort Bend Independent School District, Sugar Land, TX	<1	9	15	26	49	<1	19,779	40,471
43. Albemarle County Public Schools, Charlottesville, VA	<1	<1	<1	11	85	0	5,072	10,188
44. Alexandria City Public Schools, Alexandria, VA	<1	6	13	47	34	0	5,325	9,239
45. Fairfax County Public Schools, Fairfax, VA	3	11.2	7	10.8	70.6	.1	72,809	131,994
46. Highline School District, Seattle, WA	2.9	13.7	5.1	6.9	71.4	0	9,357	17,008
47. Spokane Public School District 81, Spokane, WA	3.5	2.9	1.3	2.7	89.6	0	17,847	30,755
48. Mercer County Schools, Princeton, WV	0	<1	<1	8	91	0	6,197	11,635
49. The Einstein Project, Inc., Green Bay, WI	3	4	1	1	91	3	21,083	38,230
50. Milwaukee City Schools, Milwaukee, WI	0	<1	<1	8	91	0	6,197	11,635
51. Department of Defense Dependents Schools	NA	NA	NA	NA	NA	NA	18,473	NA
TOTAL							1,231,194	2,373,195

At the completion of this process, the project director in charge of NSRC curriculum development traveled to each site to meet with the site coordinator, the field-test teachers, and their students to obtain information on how the hands-on science units worked in the classroom. George Hein and Sabra Price, the project's evaluation consultants from Lesley College in Cambridge, Massachusetts, interviewed all of the field-test teachers and reviewed a sample of the students' work products. Their findings were then reported to the STC project staff. Formative evaluation data obtained from the field-test sites helped the staff revise the units prior to publication.

In addition to field testing data obtained from the meetings with teachers and from the evaluation reports, the units were also reviewed by a special advisory panel composed of distinguished teachers, scientists, educators, reading specialists, and authors of children's books. Their reviews also provided the staff with information about the scientific accuracy and pedagogical appropriateness of the materials. This advisory panel includes several people with special expertise and experience in equity issues related to science education for minorities and women. The members of the advisory panel can be found on Table 5 on page 19.

Using the information obtained from the field-test teachers, the evaluators, and the Advisory Panel, the field-test editions were then revised and prepared for commercial publication. This process included the revision of both the teacher's guide and the student activity book, the selection of photographs to complement the lessons, the incorporation of additional illustrations to accompany the text, and final art for the cover.

Following the revision process, the materials underwent a final technical review by members of the advisory panel prior to final publication. The materials were again reexamined to ensure

that they were clearly written, scientifically accurate, and pedagogically appropriate. A summary of the complete NSRC curriculum materials research and development process is summarized on Table 6 on page 20.

In order to make the units commercially available to school districts throughout the nation and overseas, the NSRC negotiated a publishing agreement with Carolina Biological Supply Company of Burlington, North Carolina. The largest science education supply company in the world, Carolina Biological Supply Company is well known by teachers, principals, and science supervisors for the high quality of its materials, equipment, and services.

Carolina Biological agreed to bear the costs of producing, marketing, and distributing the complete program of 24 units in exchange for exclusive distribution rights in the United States, Canada, and most of Europe. The NSRC has retained the rights to distribution in Mexico and in developing nations.

To date, the project teams have trial taught 18 units with elementary school children in the District of Columbia Public Schools. Fourteen of these have been field tested nationwide. Of the 14, six units have been commercially published and are available through Carolina Biological. They include The Life Cycle of Butterflies (grade 2), Plant Growth and Development (grade 3), Electric Circuits (grade 4), Microworlds (grade 5), Magnets and Motors (grade 6), and Experiments with Plants (grade 6).

The remaining eight are being prepared for commercial publication. The field-test editions of these units are available from the NSRC. They include Comparing and Measuring (grade 1), Weather and Me (grade 1), Chemical Tests (grade 3), Sounds (grade 3), Floating and Sinking (grade 4), Food Chemistry (grade 5), Ecosystems (grade 5), and Time (grade 6).

Table 5

Science and Technology for Children Advisory Panel

Peter Afflerbach, Director, The Reading Clinic; Associate Professor, Curriculum and Instruction,
University of Maryland, College Park, Maryland

David Babcock, Director, Board of Cooperative Educational Services, Second Supervisory District,
Monroe-Orleans Counties, Spencerport, New York

Judi Backman, Math/Science Coordinator, Highline Public Schools, Seattle, Washington

Albert V. Baez, President, Vivamos Mejor/USA, Greenbrae, California

Andrew R. Barron, Associate Professor of Chemistry, Harvard University, Cambridge, Massachusetts

DeAnna Banks Beane, Project Director, YouthALIVE, Association of Science-Technology Centers, Washington, D.C.

Al Buccino, Education Advisor, Office of Science and Technology Policy, Executive Office of the President, Washington,
D.C.

Audrey Champagne, Professor of Chemistry and Education, Chair of Educational Theory and Practice, School of Education,
State University of New York at Albany, Albany, New York

Sally Crissman, Faculty Member, Lower School, Shady Hill School, Cambridge, Massachusetts

Gregory Crosby, National Program Leader, U.S. Department of Agriculture Extension Service/4-H, Washington, D.C.

JoAnn E. DeMaria, Elementary School Teacher, Hutchison Elementary School, Herndon, Virginia

Hubert M. Dyasi, Director, City College Workshop Center, City College of New York, New York, New York

Timothy H. Goldsmith, Professor of Biology, Yale University, New Haven, Connecticut

Charles N. Hardy, Assistant Superintendent, Instruction and Curriculum, Highline Public Schools, Seattle, Washington

Patricia Jacobberger Jellison, Geologist, National Air and Space Museum, Smithsonian Institution, Washington, D.C.

Patricia Lauber, Author, Weston, Connecticut

John Layman, Professor of Physics, University of Maryland, College Park, Maryland

Sally Love, Museum Specialist, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Phyllis R. Marcuccio, Assistant Executive for Publications, National Science Teachers Association, Arlington, VA

Lynn Margulis, Professor of Biology, University of Massachusetts, Amherst, Massachusetts

Margo A. Mastropieri, Co-director, Mainstreaming Handicapped Students in Science Project, Purdue University, West
Lafayette, Indiana

Richard McQueen, Specialist, Science Education, Multnomah Education Service District, Portland, Oregon

Alan Mehler, Professor, Department of Biochemistry and Molecular Science, College of Medicine, Howard University,
Washington, D.C.

Philip Morrison, Professor of Physics, Emeritus, Massachusetts Institute of Technology, Cambridge, Massachusetts

Phylis Morrison, Educational Consultant, Cambridge, Massachusetts

Fran Nankin, Editor, *SuperScience Red*, Scholastic, Inc., New York, New York

Jerome Pine, Professor of Physics, California Institute of Technology, Pasadena, California

Harold Pratt, Director, Middle School Science Project, Jefferson County Public Schools, Golden, Colorado

Wayne E. Ransom, Executive Director, Education, Franklin Institute, Philadelphia, Pennsylvania

David Reuther, Editor-in-chief and Senior Vice-President, William Morrow Books, New York, New York

Robert Ridky, Associate Professor of Geology, University of Maryland, College Park, Maryland

F. James Rutherford, Chief Education Officer and Director, Project 2061, American Association for the Advancement of
Science, Washington, D.C.

David Savage, Training Specialist, Office of Instruction and Program Development, Rockville, Maryland

Thomas E. Scruggs, Co-director, Mainstreaming Handicapped Students in Science Project, Purdue University, West
Lafayette, Indiana

Larry Small, Science/Health Coordinator, Schaumburg School District 54, Schaumburg, Illinois

Michelle Smith, Publications Coordinator, Office of Elementary and Secondary Education, Smithsonian Institution,
Washington, D.C.

Susan Sprague, Director of Science and Social Studies, Mesa Public Schools, Mesa, Arizona

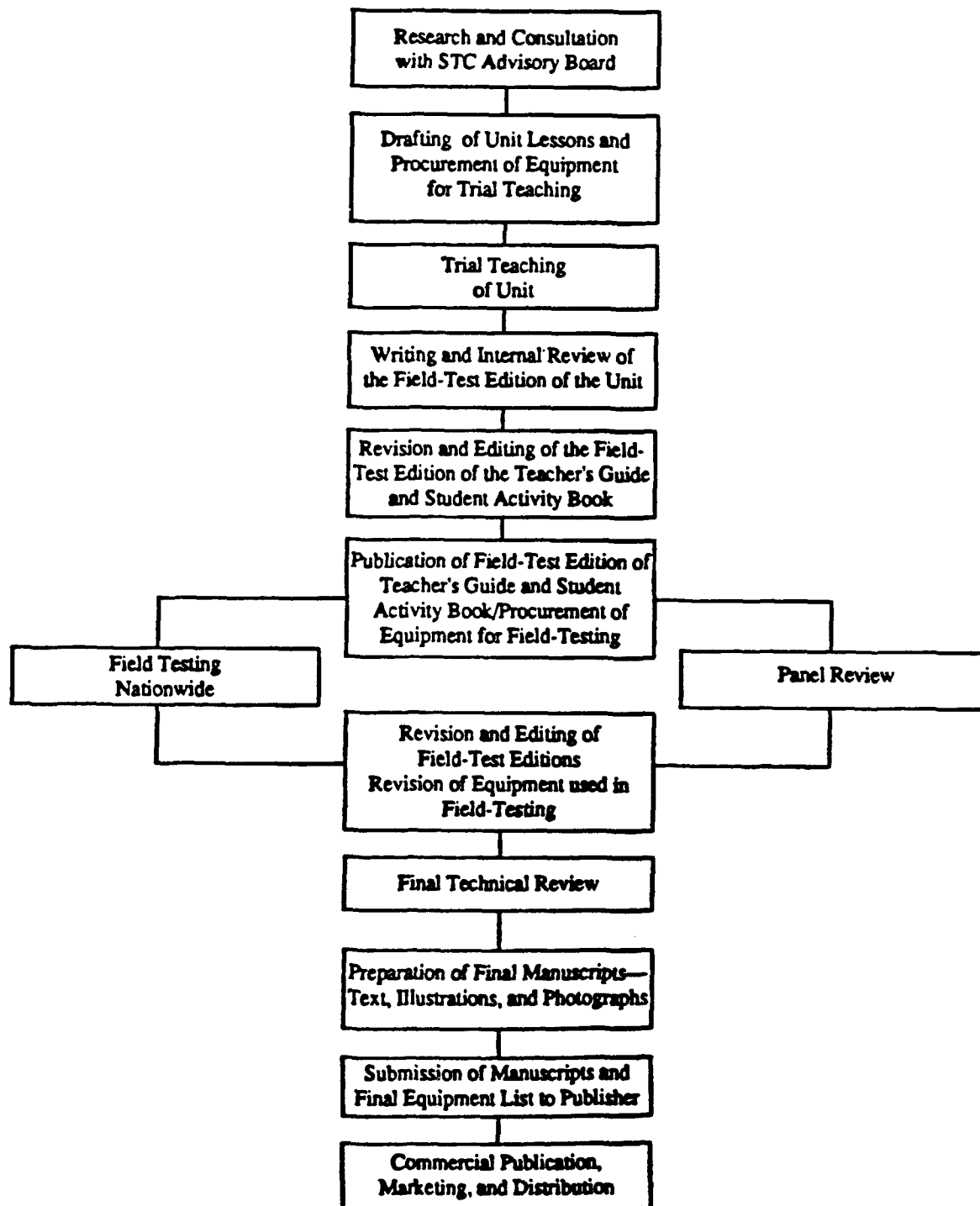
Arthur Sussman, Director, Far West Regional Consortium for Science and Mathematics, Far West Laboratory, San Francisco,
California

Emma Walton, Science Program Coordinator, Anchorage School District, and Past President, National Science Supervisors
Association, Anchorage, Alaska

Paul H. Williams, Director, Center for Biology Education; and Professor, Department of Plant Pathology, University of
Wisconsin, Madison, Wisconsin

Table 6

**Science and Technology for Children
Unit Research and Development Process**



One set of the available field-test and commercial editions of NSRC's hands-on elementary science units have been enclosed with the report sent to the Office of the Deputy Director of Defense Research and Engineering/Research and Advanced Technology. Additional copies can be obtained by DoD upon request. More information about the units is contained in Appendix C.

To disseminate information about the units, a comprehensive plan was developed. These dissemination activities are outlined in Table 7 on page 22 and described in detail below.

In the spring of 1991, Carolina Biological sponsored a series of workshops and a reception to launch the publishing of the first three curriculum units at the National Science Teachers Association National Convention in Houston. During the convention, elementary school teachers from seven states (California, Colorado, Kentucky, Massachusetts, South Carolina, Virginia, and Washington) worked with the publisher and the NSRC staff to conduct hands-on workshops for 250 elementary school teachers and science educators.

At the reception, over 900 educators and scientists were introduced to the units. The reception also featured the premiere showing of Carolina Biological's promotional videotape about the units, "Setting the Stage for Science Learning: Science and Technology for Children." Featured in the videotape were interviews with Massachusetts Institute of Technology physicist Philip Morrison, and a number of teachers and science educators who have worked with the project. A copy of this videotape can be obtained from Carolina Biological.

Since 1991, Carolina Biological Supply Company staff and teacher consultants have conducted more than 100 hands-on workshops attended by more than 2,000 teachers and school

Table 7

**Science and Technology for Children
Planning Chart for STC Dissemination Activities**

National Science Resources Center Activities	Carolina Biological Supply Company Activities
<ul style="list-style-type: none"> • Sponsorship of NSRC Elementary Science Leadership Institutes for 172 school districts representing 4 million elementary school children from diverse ethnic populations-- 42 districts - 1989-91; 130 districts - 1992-96 • Organization of presentations and hands-on workshops for teachers and school administrators from school districts throughout the country • Provision of technical assistance to school districts implementing the STC program • NSRC Association of Science Materials Centers for school districts establishing centers to supply elementary school teachers with kits of science equipment and materials • Dissemination of information on STC units to NSRC resource-sharing network of 14,000 elementary school teachers, educators, scientists • Organization of presentations at meetings and conferences of professional organizations, museums, corporations, and colleges and universities • Biannual distribution of <i>NSRC Newsletter</i> to nation's 16,000 superintendents of schools and 14,000 members of NSRC Network • Annual distribution of 10,000 copies of the STC brochure at meetings and by mail to teachers, school administrators, and scientists • Publication of information about the STC program through news conferences, television programs, and newspaper and journal articles 	<ul style="list-style-type: none"> • Sponsorship of reception to launch publication of STC program materials for 1,000 teachers and school administrators at 1991 NSTA convention in Houston • Provision of partial funding support for NSRC Elementary Science Leadership Institutes from 1992-1995 • Sponsorship of hands-on STC workshops for teachers and school administrators from school districts throughout the country led by elementary school teachers • Presentation of information about the STC program to school districts, museums, corporations, and other groups • Distribution of STC brochure and the STC program flyer to the nation's 60,000 elementary schools • Dissemination of information about the STC program in Carolina's supply catalog distributed to 87,800 teachers and school administrators • Dissemination of information about the STC program in <i>Carolina Tips</i>, a newsletter-like publication distributed to 109,500 teachers and school administrators • Distribution of STC teacher's guides, student activity books, and equipment at reasonable costs as entire units or individual components • Production and dissemination of videotape describing the STC program

administrators from 35 locations in 19 states. A flier describing the units and a copy of Carolina's flier describing the program materials were also distributed to the nation's 60,000 elementary school principals.

Future plans include the continued sponsorship of presentations and workshops for teachers and administrators, and the nationwide dissemination of information about the materials through the Carolina newsletter, direct mailings of informational brochures, and Carolina's supply catalog that is sent annually to 87,000 teachers and administrators.

In addition to the publisher's marketing and dissemination efforts, the NSRC organized a variety of activities to disseminate information about the project's units to science educators and scientists throughout the country. These activities included the NSRC's Elementary Science Leadership Institutes, presentations at meetings of professional associations and organizations, and the provision of technical assistance to school districts that are seeking to improve their elementary science programs.

Major support for this portion of the project has been provided by the Amoco Foundation, Dow Chemical Company Foundation, E.I. du Pont de Nemours and Company, Hewlett-Packard, John D. and Catherine T. MacArthur Foundation, the National Science Foundation (NSF), and the U.S. Department of Education.

Conducted Leadership Development Activities for Educators and Scientists. Over the past five years, the NSRC conducted a program of leadership development activities. NSRC Elementary Science Leadership Institutes were conducted to provide leadership teams from school districts with the information and skills they need to develop a comprehensive plan of action to

improve the elementary science programs in their districts.

To disseminate information about the institutes and the application process, the NSRC produced and disseminated 5,000 copies of a brochure annually to state and local science alliances, states participating in the NSF State Systemic Initiatives Program, members of the NSRC network, and superintendents of schools and science supervisors of the nation's 2,000 largest school districts. These 2,000 school districts represent approximately 60 percent of the elementary student population in the United States and overseas.

School districts that requested an application form were asked to identify an "action team" consisting of individuals who have the abilities needed to lead an elementary school science reform effort in their communities. A screening committee reviewed the applications and selected school districts to participate in the leadership institutes, using the following criteria:

- how clearly the school district has identified its elementary science program needs;
- nature of the school district's current plans to implement a hands-on elementary science program;
- evidence of the school district's commitment to provide the resources needed to establish a hands-on elementary science program;
- leadership skills and expertise of the members of the action team selected by the school district; and
- nature of the population served by the school system.

Districts that demonstrated a commitment to the improvement of their elementary science programs were encouraged to apply to attend the institutes. From the pool of applicants each year, school districts that served significant numbers of children from

populations that are under-represented in science and technology were given priority in the selection process. The NSRC worked with the NSRC Advisory Board and members of its established network of educators and scientists to identify such districts.

Each action team was composed of four or five individuals . They included (1) an experienced classroom teacher who has demonstrated leadership abilities; (2) a science coordinator, director of curriculum and instruction, or director of elementary education; (3) a superintendent of schools or an assistant superintendent for curriculum and instruction; and (4) a scientist from a local industrial corporation, governmental agency, or university.

Following the selection process, the NSRC asked each participating district to provide a description of its elementary science curriculum, the current state and local guidelines for elementary science education, and a description of efforts that are already underway to improve the district's elementary science program. This information was used to assess the needs of each participating school district, to ascertain the participants' special needs, and to help the staff in planning the institute program.

Each institute enhanced the leadership skills of the participants by engaging them in workshops and discussions on the important elements of an effective elementary science program. The topics addressed included:

- (1) the identification of science instructional materials that are effective for teaching elementary school children of various ages;
- (2) the organization of in-service education programs that prepare elementary school teachers to teach hands-on science;

Table 8

**1989-1992 Elementary Science Leadership Institutes:
Participating Teams**

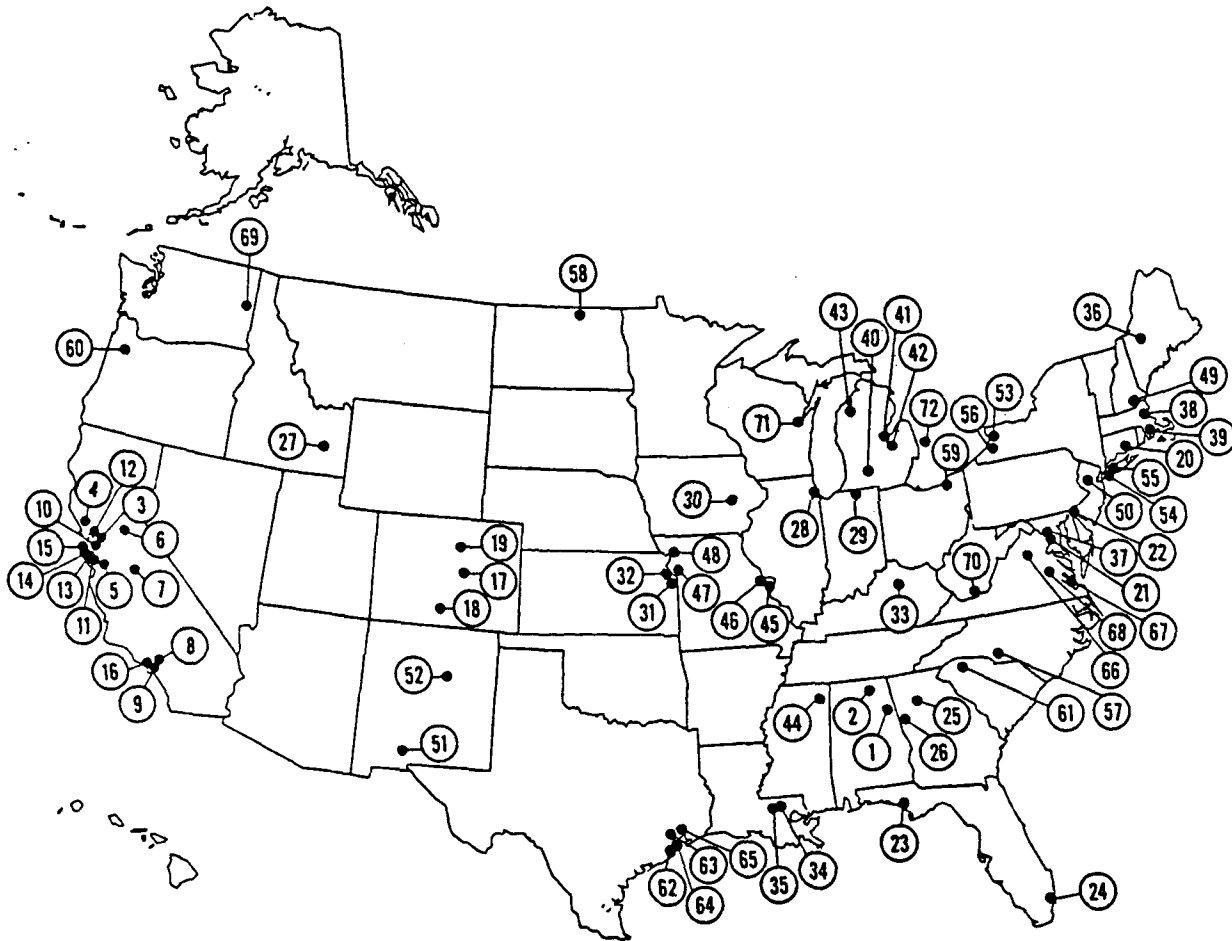


Table 9

**1989-1992 Elementary Science Leadership Institutes:
Participating Teams**

School District	Percentage of enrollment						Actual enrollment	
	American Indian	Asian or Pacific Islander	Hispanic	Black, not Hispanic origin	White, not Hispanic origin	Other	Elementary students	Total students
1. Anniston City Schools, Anniston, AL	0	<1	1	76	23	0	2,123	4,183
2. Huntsville City School System, Huntsville, AL	0	0	0	34	66	0	12,401	24,338
3. Antioch Unified School District, Antioch, CA	1.1	5.8	17	3.5	72.6	0	8,211	13,738
4. Cotati-Rohnert Park Unified School District, Cotati, CA	1	4	9.2	3.6	81	1.2	5,781	7,445
5. Cupertino Union School District, Cupertino, CA	0	32	4.5	1.9	60	0	10,270	13,243
6. Dry Creek Joint Elem. School District, Roseville, CA	.3	3	13.1	.8	85.6	0	7,352	9,376
7. Fresno Unified School District, Fresno, CA	2	20	36	10	32	0	44,873	72,000
8. Los Angeles Unified School District/USC/Los Angeles, CA	.3	5.6	64.4	14.8	13.1	1.9	347,607	790,523
9. Lynwood Unified School District, Lynwood, CA	<1	2	77	20	<1	0	9,800	14,633
10. Mt. Diablo Unified School District, Concord, CA	.3	7.6	11.3	3.8	74.4	0	17,013	33,238
11. Mountain View/Whisman School Districts Mountain View, CA	2	1	15	290	44	0	3,476	4,730
12. Pittsburg Unified School District, Pittsburg, CA	.4	13.6	28	26	32	0	4,663	8,812
13. Ravenswood City School District, East Palo Alto, CA	0	9	51	39	1	0	4,200	4,200
14. Redwood City/Menlo Park School Districts, San Mateo, CA	.3	5.7	41.8	4.8	47.4	0	7,740	9,764
15. San Francisco Unified School District, San Francisco, CA	<1	47	19	19	14	0	29,053	62,345
16. Torrance Unified School District, Torrance, CA	.2	28	10.7	2.2	58.3	0	10,636	20,528
17. Academy School District 20, Colorado Springs, CO	.7	2.2	3.5	3.3	90.3	0	5,740	12,381
18. Alamosa School District RE-11J, Alamosa, CO	0	.5	47	.5	52	0	1,275	2,536
19. Denver Public Schools, Denver, CO	1.5	3.5	41.5	20.7	32.8	0	34,341	58,004
20. Hartford Public Schools, Hartford, CT	.1	1.4	43.9	45.3	9.4	0	16,237	25,015
21. District of Columbia Public Schools, Washington, DC	<1	<1	4	91	4	0	51,174	87,700
22. Delaware Science Alliance	<1	1	3	27	69	0	60,000	100,000
23. Bay District Schools, Panama City, FL	1	2	1	16	80	0	10,726	22,173
24. Dade County Public Schools, Miami, FL	.03	1.2	46.5	33.3	19	0	165,487	304,287
25. Fulton County School District, Atlanta, GA	.06	2.8	1.48	43.2	51.9	.03	23,415	46,989
26. Troup County School District, LaGrange, GA	0	1	0	18	81	0	2,555	5,286
27. Idaho School District 25, Pocatello, ID	<1	<1	<1	1	98	0	7,318	13,802
28. Chicago Public Schools, Chicago, IL	<1	3	25	60	12	0	297,838	410,230
29. Elkhart Community Schools, Elkhart, IN	<1	1	2	16	81	0	6,446	11,175
30. Iowa City Community School District, Iowa City, IA	<1	4.6	2.2	4.2	88.6	0	5,641	9,690
31. Shawnee Mission Public Schools, Shawnee Mission, KS	.4	2.6	2	3	92	0	17,583	30,714
32. Unified School District 500, Kansas City, KS	<1	1.9	8.5	50.5	38.9	0	11,134	22,011
33. Fayette County Public Schools, Lexington, KY	<1	1.5	<1	22.7	74.5	0	16,480	32,150
34. East Baton Rouge Parish School Dist., Baton Rouge, LA	.07	1.6	.3	55.9	42.1	0	34,460	60,653
35. Iberville/West Baton Rouge Parish School Districts, Port Allen, LA	0	.001	.001	60	40	0	4,823	9,141
36. Maine School Administrative District 58, Kingfield, ME	0	0	0	1	99	0	787	1,150

School District	Percentage of enrollment						Actual enrollment	
	American Indian	Asian or Pacific Islander	Hispanic	Black, not Hispanic origin	White, not Hispanic origin	Other	Elementary students	Total students
37. Montgomery County Public Schools, Rockville, MD	<1	12	8	16	63	0	59,367	107,783
38. Cambridge Public Schools, Cambridge, MA	0	8	14	31	46	0	5,586	7,709
39. Fall River Public Schools, Fall River, MA	<1	3.3	1.9	2.3	92.3	0	6,950	12,473
40. Battle Creek Area Schools, Battle Creek, MI	<1	<1	2	14	83	0	15,050	26,852
41. Midland Public Schools, Midland, MI	<1	2	1	2	94	0	4,568	8,547
42. School District of the City of Saginaw, Saginaw, MI	3	.9	13.2	53.3	32.2	0	9,189	14,352
43. Traverse City Public Schools, Traverse City, MI	1	<1	<1	<1	97	0	5,991	10,261
44. Lee County Schools, Tupelo, MS	0	<1	<1	29	71	0	3,256	5,457
45. School District of University City, University City, MO	0	<1	0	84.1	15.1	0	2,362	4,678
46. Schools of the Archdiocese of St. Louis, St. Louis, MO	<1	1	<1	6	92	0	45,304	59,149
47. The School District of Kansas City, Kansas City, MO	<1	1	4	69	25	0	18,896	34,348
48. St. Joseph School District, St. Joseph, MO	0	0	1	5	94	0	6,941	12,467
49. Nashua School District, Nashua, NH	<1	2.5	4.6	2.4	90.4	0	7,117	11,884
50. North/Central Hunterdon Elementary Science Consortium, Readington, NJ	.1	2.4	1.1	1.2	95.2	0	9,440	9,440
51. Las Cruces Public Schools District 2, Las Cruces, NM	1	0	54	1	44	0	9,100	18,100
52. Santa Rosa Consolidated Schools No. 8, Santa Rosa, NM	<1	<1	92	<1	7	0	518	825
53. Buffalo Public Schools, Buffalo, NY	1.2	1.1	8.7	48.7	39.9	0	29,602	48,252
54. Community School District 16, Brooklyn, NY	0	0	8	92	0	0	9,422	11,860
55. Community School District 26, Bayside, NY	0	27	8	11	54	0	8,980	14,181
56. Erie 2-Chautauqua-Cattaraugus BOCES School District, Angola, NY	3	5	7	3.2	86.3	0	33,481	44,898
57. Charlotte-Mecklenburg Schools, Charlotte, NC	<1	2	<1	39	59	0	41,142	74,595
58. Turtle Mountain Schools, Belcourt, ND	97	0	0	0	2	0	1,691	2,193
59. Cleveland Public Schools, Cleveland, OH	<1	1	5	70	24	0	42,322	72,116
60. Corvallis, School District 509J, Corvallis, OR	<1	2.9	1.9	.7	92.6	1.7	4,307	7,595
61. Greenville County School District, Greenville, SC	<1	<1	<1	26	72	0	26,189	53,049
62. Brazosport Independent School District, Freeport, TX	0	1.3	29	8.1	61.7	0	6,532	12,381
63. Fort Bend Independent School District, Sugar Land, TX	<1	9	15	26	49	<1	19,779	40,471
64. Southern Brazoria County Coalition, Angleton, TX	<1	.4	16.3	14.5	68.6	0	6,109	12,856
65. Spring Independent School District, Houston, TX	<1	5	14	15	65	0	9,650	19,106
66. Albemarle County Public Schools, Charlottesville, VA	<1	<1	<1	11	85	0	5,072	10,188
67. Hampton City Public Schools, Hampton, VA	1	2	1	47	47	0	11,427	22,570
68. Henrico County Public Schools, Richmond, VA	<1	3	<1	27	69	0	15,528	31,963
69. Spokane Public School District 81, Spokane, WA	3.5	2.9	1.3	2.7	89.6	0	17,847	30,755
70. Mercer County Schools, Princeton, WV	0	<1	<1	8	91	0	6,197	11,635
71. The Einstein Project, Inc., Green Bay, WI	3	4	1	1	91	3	21,083	38,230
72. Lambton County Partnership, Sarnia, Ontario, Canada	1.6	3	0	3	97.7	0	18,334	27,019
TOTAL							1,842,988	3,288,361

- (3) strategies that can help to integrate science with other areas of the elementary science curriculum;
- (4) assessment methods that can be used to evaluate student performance that are consistent with the goals of a hands-on elementary science program;
- (5) support systems that can be used to supply elementary school teachers with science equipment and materials; and
- (6) strategies that can build administrative and community support for a hands-on elementary science program.

The leadership institutes built on recent national elementary science curriculum reform efforts by featuring workshops on the materials produced by projects such as Education Development Center's Insights program, the Lawrence Hall of Science's FOSS and GEMS programs, and the NSRC's Science and Technology for Children program. A special effort was also made to invite participation in the leadership institutes from school districts that are receiving grants from the Eisenhower Grants Program and the NSF Systemic Initiatives Program.

The Elementary Science Leadership Institutes were held in the S. Dillon Ripley Center of the Smithsonian Institution during the summers of 1989 through 1992. The institute staff included school district personnel who have developed and implemented effective hands-on elementary science programs, and scientists and other resource people from the Smithsonian Institution and the National Academy of Sciences. The Smithsonian Institution and the National Academy of Sciences provided the facilities for the institutes. The participating school districts were responsible for providing transportation expenses for their teams.

Seventy-two teams representing 127 school districts, serving over 1.8-million elementary school children in 34 states, the

District of Columbia, and Ontario, Canada, have participated in the five NSRC Elementary Science Institutes held from 1989-1992. The racial and ethnic diversity of the students in these school systems is quite broad. Table 8 illustrates the geographic distribution of the districts on page 26; Table 9 provides data related to enrollment and the ethnic diversity of each district on pages 27 and 28. See Appendix D for the Leadership Institute brochure; application form; program; and correspondence received from some of the participants.

In addition to leadership institutes, the NSRC held its first "Working Conference on Precollege Science Education for Scientists and Engineers" this year at the California Institute of Technology in Pasadena, California, from March 7-13. The NSRC worked with the NSRC Advisory Board and its sponsoring institutions to identify scientists who would benefit from participating in this conference. The NSRC developed and disseminated a brochure describing the conference, and invited applications from members of state and local science alliances, states participating in the NSF's State Systemic Initiatives Program, colleges and universities, and members of the NSRC science education network. Interested individuals were asked to submit applications to be reviewed by a screening committee.

The 28 scientists and engineers representing colleges and universities, federal research facilities, and private industry who were selected to attend the conference shared their experiences in working to improve K-12 science education and gained insights about effective roles they could play in working to improve the teaching of science in the nation's schools. Roles discussed included:

- working with teachers to contribute to the development of high-quality teaching materials and resources;
- participating in the in-service and pre-service

- education of teachers;
- working collaboratively with teachers to help them teach science more effectively;
- acting as advocates for the establishment of hands-on, inquiry-based school science programs in their local communities; and
- working collaboratively with school districts to help them create and sustain effective science programs.

Throughout the seven days of the conference, participants discussed the characteristics of effective science instructional materials; became acquainted with a variety of K-12 hands-on curriculum materials; discussed effective strategies for teaching science to elementary and secondary school teachers and children; developed frameworks for bringing scientists and engineers into effective collaboration with their local schools; developed plans for the work they will do in their districts when they return; and discussed strategies for stimulating policy changes at the local and state level that will encourage improvements in elementary science education.

Presenters included master elementary and secondary school science teachers, leading science educators, experts in cognitive development and the assessment of science learning, and scientists and engineers engaged in projects to improve science education in the schools.

On the closing day, conferees agreed that "significant change is needed and significant change is possible." In consensus, conferees noted that significant change is possible only if the scientific and engineering communities become actively involved in forming alliances with school districts to build better science programs. These alliances should have as their goal the effective collaboration of teachers, scientists, and engineers to bring about systemic reforms in science

education. It was also agreed that more scientists and engineers need to become engaged in this effort.

A map illustrating the geographic distribution of the participants can be found on Table 10 on the next page; the list of participants is included on Table 11 on page 34. Additional information regarding the 1992 conference has been compiled in Appendix E, including a conference application, brochure, and program.

Provided Technical Assistance. The NSRC received many requests for follow-up assistance from Leadership Institute teams as their school districts began to implement the action plans drawn up during the institutes. The NSRC responded to these requests by phone and mail and through referrals to appropriate sources of assistance. The NSRC also started developing the capability to provide technical assistance to such school districts.

Through a variety of networking activities and responses to individual requests, the NSRC served as a source of information and specialized expertise. Technical assistance activities included helping leadership institute school districts as well as others identify effective science curriculum materials, design teacher in-service education programs, establish effective science materials support systems and build community support for their science programs. Upon request, staff members or NSRC consultants made on-site visits.

In addition, special efforts were made to assist the state projects that are a part of the NSF State Systemic Initiatives Program, as well as other elementary science improvement efforts initiated by science alliances and partnerships, state departments of education, and state science teachers associations.

Table 10

**1992 Working Conference for Scientists and Engineers
on Precollege Science Education:
Participants**

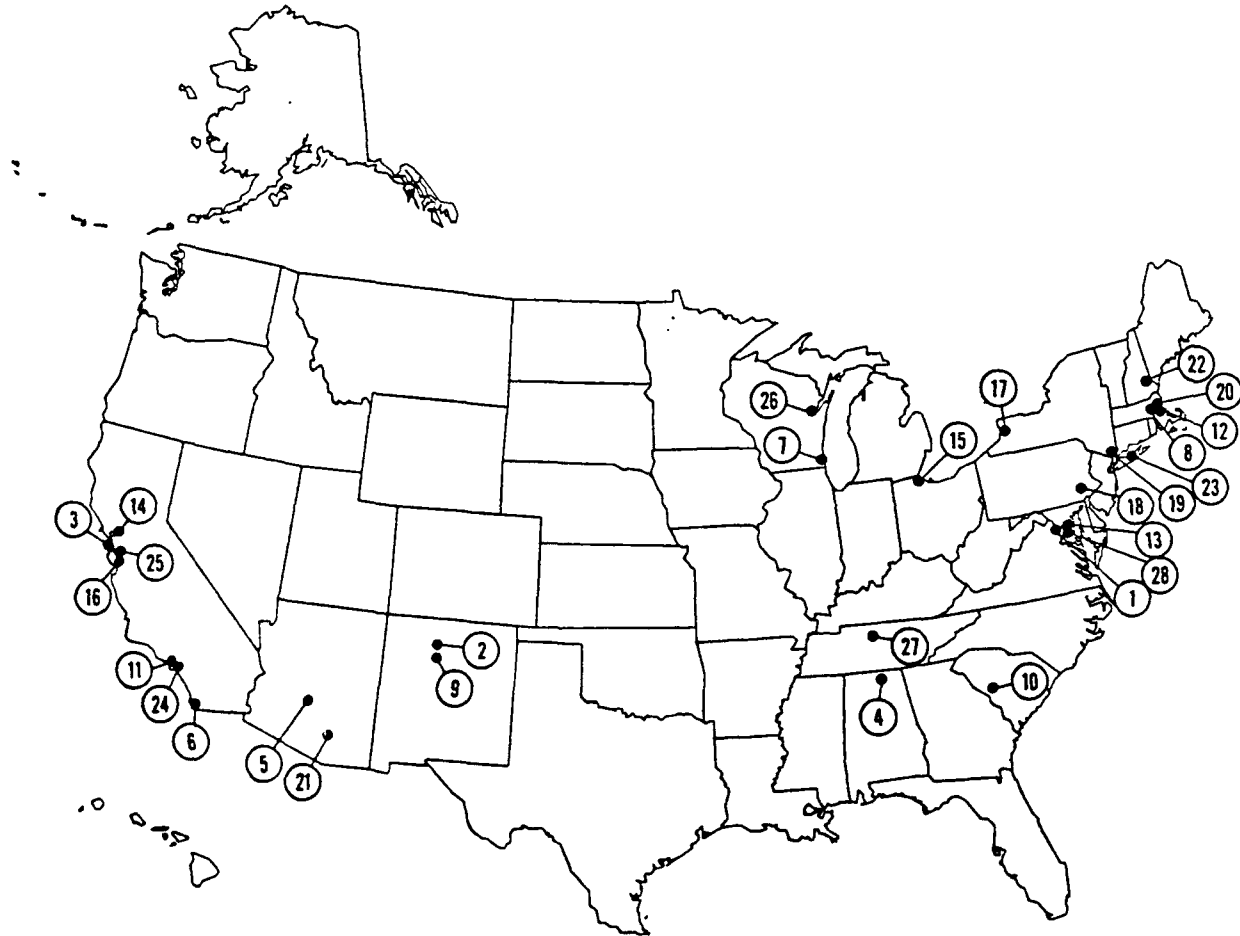


Table 11

**1992 Working Conference for Scientists and Engineers
on Precollege Science Education:
Participants**

- | | |
|---|--|
| 1. J. Henry Ambrose, Arlington, VA | 16. Ellen P. Metzger, San Jose, CA |
| 2. Fred Begay, Los Alamos, NM | 17. Robert C. Najjar, Tonawanda, NY |
| 3. Margaret R. Clark, San Francisco, CA | 18. Gregory E. Reaves, West Point, PA |
| 4. F. Lee Cook, Huntsville, AL | 19. Theodore D. Schultz, Yorktown Heights,
NY |
| 5. Karen Conzelman, Glendale, AZ | 20. Michael B. Silevitch, Boston, MA |
| 6. A. Steven Dahms, San Diego, CA | 21. Alan F. Smith, Tuscon, AZ |
| 7. Robert M. Fitch, Racine, WI | 22. Otis J. Sproul, Durham, NH |
| 8. Burton Goodrich, Maynard, MA | 23. Karl J. Swyler, Upton, NY |
| 9. Raymond B. Heath, Albuquerque, NM | 24. Mare Taagepera, Irvine, CA |
| 10. Michael E. Hodges, Aiken, SC | 25. Hector Timourian, Livermore, CA |
| 11. Susan Kanowith-Klein, Los Angeles, CA | 26. David Turriff, Green Bay, WI |
| 12. Alan J. Lazarus, Cambridge, MA | 27. Carolyn Ruth A. Williams, Nashville, TN |
| 13. Ramon E. Lopez, Laurel, MD | 28. Vera Zdravkovich, Largo, MD |
| 14. Jan B. Loveless, Pittsburg, CA | |
| 15. Edward Lumsdaine, Toledo, OH | |

The NSRC also sponsored follow-up annual meetings for Leadership Institute participants at the National Science Teachers Association (NSTA) National Conventions. The 1992 reunion of the 1989-1991 institute participants was held at the NSTA National Convention in Boston, Massachusetts, on March 28, 1992. Twenty-three leadership teams were represented.

These reunions provided an opportunity for the NSRC staff to obtain information on participants' needs, as well as recent developments in their school districts. The meetings also enabled the participants to share ideas and strategies they have used to improve science teaching in their elementary schools. In addition to these reunions, direct contact between the NSRC and institute participants was maintained through telephone and mail communications, and through a computer telecommunications network.

The NSRC also continued to sponsor the Association of Science Materials Centers (ASMC), an NSRC organization which assists the growing number of school districts that are establishing district-wide science materials support systems. ASMC members met annually to share information about the design of science teaching apparatus, sources of supply, and strategies for reducing the cost of hands-on science instruction.

In attendance at the third annual ASMC meeting were 100 representatives whose school districts are in various stages of developing and operating science materials support centers. It is anticipated that interest and participation in the organization will continue to grow as more school systems move to improve their elementary science programs.

Information about project activities and publications was published biannually (spring and fall) in the NSRC Newsletter. The newsletter was disseminated to the 16,000 members of the NSRC

Network, and to the nation's 16,000 superintendents of schools. (Recent editions of the NSRC Newsletter and other information about technical assistance activities are included in Appendix F).

During FY 1993, the NSRC plans to build on the accomplishments of the past five years. The NSRC will continue to concentrate on its three major program areas - outreach, information dissemination, and resource materials development as described in the NSRC brochure in Appendix A. In all of the NSRC's project activities, participation by DODDS elementary schools and by other school systems serving children of military personnel in the United States will be given priority.

APPENDICES

- A.** NSRC Advisory Board and brochure
- B.** NSRC "Science for Children: An Agenda for Action" brochure
- C.** Information about hands-on elementary science (STC) units
- D.** NSRC Elementary Science Leadership Institute information
- E.** 1992 Working Conference on Precollege Science Education for Scientists and Engineers information
- F.** Networking and technical assistance information

APPENDIX A

NSRC ADVISORY BOARD AND BROCHURE

Nature's Own Researcher

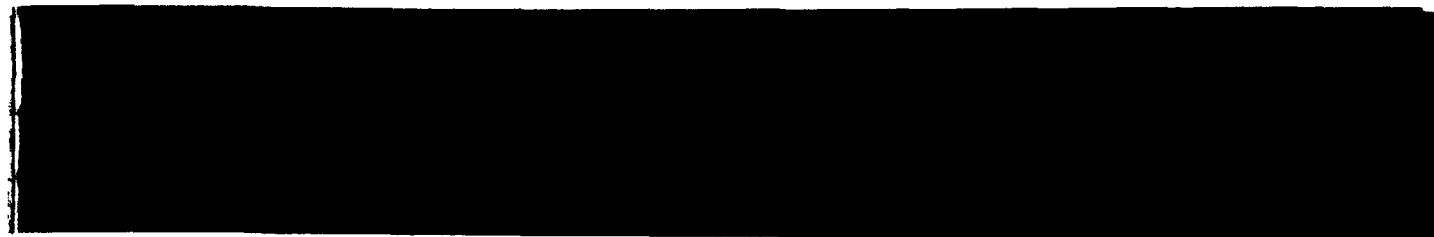


Established in 1985, the National Science Resources Center is operated jointly by the Smithsonian Institution and the National Academy of Sciences.

The NSRC's mission is to improve the teaching of science in the nation's schools by

- Developing a talent pool of informed leaders in science education to staff local, state, and regional reform efforts;
- Developing consensus on needed improvements in science education and on ways to achieve them;
- Creating networks of individuals and organizations to promote the exchange of knowledge and experience useful to the improvement of science education;
- Providing expertise and technical assistance to help school systems improve their science programs;
- Collecting and disseminating information about science and teaching resources to science educators and scientists;
- Developing effective science teaching materials for precollege science education.





The work of the NSRC is in three principal program areas:

- National outreach, to build consensus on important science education issues and to develop the leadership needed to bring about change in the schools.
- Dissemination of information about exemplary teaching resources, science education programs, and sources of expertise and assistance.
- Development of innovative science curriculum materials that are imaginative, classroom-tested, scientifically accurate, and reflective of current knowledge about how children learn.

All NSRC programs feature the active involvement and collaboration of science educators with scientists and engineers. The NSRC provides science educators with opportunities to become better informed about current developments in science and technology, and enables scientists and engineers to become familiar with current issues in precollege science education so that they can play an active role in its improvement.

NATIONAL OUTREACH

The NSRC's National Outreach Program works closely with teachers, school system officials, parent and community organizations, and representatives of business and industry to stimulate public support for the reform of science education and to enhance local, regional, and state efforts to improve science teaching in the schools. National Outreach activities are designed to develop broad consensus on needed improvements in science education, to develop a talent pool of informed leaders who can direct science education reform efforts in their communities, and provide these leaders with specialized technical assistance.

National Convocations


To develop consensus and public support for needed reforms in science education, the NSRC sponsors convocations for leaders from school districts, state departments of education, colleges and universities, professional organizations, and business and industry. The NSRC's first national convocation, held in 1986, focused on the teaching of science in elementary schools. The recommendations that emerged from this convocation are summarized in the NSRC publication, "Science for Children: An Agenda for Action."



Future NSRC convocations will bring state and local leaders together to identify and discuss effective strategies for bringing about sustainable change in middle and high school science education.

Leadership Institutes

Informed leadership is required to establish a effective, hands-on science program in every school district. To help develop this leadership at the elementary school level, the NSRC conducts two Elementary Science Leadership Institutes each summer. These institutes



provide teams of administrators, curriculum specialists, teachers, and scientists from school districts across the country with the information and skills they need to develop and maintain effective hands-on elementary science programs. The institutes are staffed with science educators and scientists who have implemented exemplary elementary science programs in their districts.

During the past four years, 72 school district teams have participated in NSRC Leadership Institute programs. These districts serve nearly two million elementary school children.

Working Conferences for Scientists and Engineers

Each year, the NSRC sponsors a working conference for scientists and engineers from colleges and universities, federal research laboratories, and private industry. These conferences are designed to prepare scientists and engineers for leadership roles in precollege science education.

The conferences enable participants to become informed about current issues and new developments in science and technology education. Conference discussions are designed to help participants identify ways in which they can contribute to the improvement of K-12 science education by working with teachers to develop new science teaching

materials; participating in the pre-service and in-service education of science teachers; working with school districts to help them create and maintain effective science education programs; and acting as advocates for the improvement of science education in their local communities.

Technical Assistance

The NSRC provides technical assistance to school districts that are engaged in efforts to improve their science programs. Through a variety of networking activities and responses to individual requests, the NSRC serves as a source of information and specialized expertise in science and technology education for school district and community leaders. NSRC technical assistance activities include helping school districts identify effective science curriculum materials, design teacher in-service education programs, establish effective science materials support systems, and build community support for their science programs.

In response to a special need to help large numbers of districts establish effective science materials support systems, the NSRC has established the Association of Science Materials Centers (ASMC). ASMC members meet annually to share information about the design of science teaching apparatus, sources of supply, and strategies for reducing the cost of hands-on science instruction.

DISSEMINATING INFORMATION

The NSRC maintains a resource collection and computer databases which contain information about effective science teaching resources and sources of expertise and assistance. The NSRC provides information about resources for the improvement of science education both to school systems and to individual science educators and scientists. The NSRC disseminates information through computer telecommunication networks, the *NSRC Newsletter*, presentations at conferences and workshops, and the publication of printed, annotated guides.



Resource Collection

The NSRC has a comprehensive and growing collection of effective science teaching resources. Housed in the NSRC library at the Smithsonian Institution, the collection holds over 5,000 volumes, including

- Science curriculum materials developed by national curriculum projects and by school systems with exemplary science programs, including adaptations of materials produced by national science curriculum projects;
- Textbooks, science activity guides, and other materials developed by commercial publishers;
- Science teaching materials developed by science museums and science-technology centers;
- Curriculum materials developed in other countries.

Information Databases

The NSRC resource collection is catalogued and accessible through computerized information databases that include annotations as well as bibliographic data. Off-site users can access the data by sending requests through the People Sharing Information Network (PSI-NET). (PSI-NET is a nationwide computer telecommunications network organized by the Council of State Science Supervisors.)

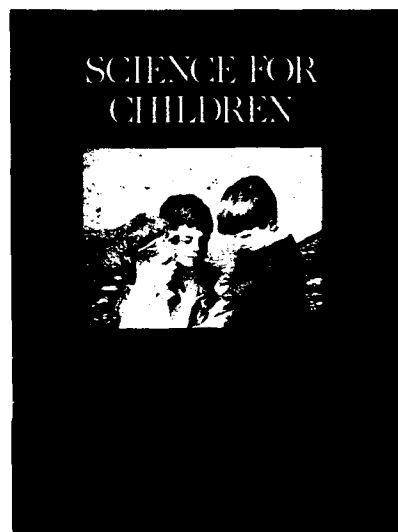
In the future, the NSRC will also disseminate its information databases through other telecommunications networks that serve the educational community.

Resource Guides

NSRC resource guides include information about teaching materials and sources of assistance for science teachers. An elementary science resource guide has been published, and a guide for secondary school science is under development.

Science for Children: Resources for Teachers is the NSRC's annotated guide to elementary science resources. The guide contains hundreds of carefully researched entries about

- Elementary science curriculum materials that support hands-on science instruction;
- Periodicals on science and science education for children and teachers;
- National elementary science curriculum development projects;
- Assistance available to elementary school teachers from museums, science and technology centers, and professional associations and organizations across the country;
- Publishers and suppliers of elementary science teaching materials.



In 1990, the first edition of *Science for Children: Resources for Teachers* received the "Outstanding Academic Book Award" from the American Library Association. A second edition is under development.

Science for Children: Resources for Teachers is available from the National Academy Press. To order, write: National Academy Press, 2101 Constitution Ave., NW, Washington, DC 20418.

DEVELOPING INNOVATIVE SCIENCE CURRICULUM MATERIALS

The NSRC curriculum project, Science and Technology for Children (STC), is producing a complete program of science instruction for children in grades one through six. Developed in cooperation with school districts across the country, the 24 STC curriculum units involve children in hands-on investigations of scientific phenomena that enable them to learn science by doing science.

The goals of the STC program are

- To help children develop scientific reasoning skills and the ability to solve practical problems;
- To contribute to children's conceptual understanding of the world around them;
- To foster the development of scientific attitudes—curiosity, respect for evidence, critical reflection, flexibility, and sensitivity to living things.

Each STC unit consists of approximately 16 lessons, or eight weeks of instruction. Everything a teacher needs—a teacher's guide, a set of student activity books, and classroom science materials—is contained in an STC unit.



Based on Research

The design of the STC program is based on research that shows children learn more science through hands-on experiences than through rote memorization of technical terms from textbooks.

Classroom-Tested

To ensure that the materials produced by the STC project are effective for children and teachers in actual classroom settings, the unit development process includes two phases of testing with students and teachers in classrooms across the country. In addition, the STC units are reviewed by an advisory panel of scientists and educators.

Designed to Integrate Learning

The STC units make science instruction more meaningful to children and more manageable for elementary school teachers by linking science with other curriculum subjects, including mathematics, language arts, social studies, and art.

Flexible and Affordable

The modular design of the STC program makes it possible for school districts to incorporate STC units into a variety of curriculum frameworks. In addition, the STC units are also designed to be affordable and easily maintained by school districts.

STC units may be purchased from the Carolina Biological Supply Company, 2700 York Rd., Burlington, NC 27215. Telephone: (919) 584-0381.



An Advisory Board of distinguished scientists, educational leaders, and corporate executives helps set NSRC priorities and reviews materials produced by the center.

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Established in 1985, the NSRC is located in the
Arts and Industries Building of the
Smithsonian Institution in Washington, D.C.

For further information about the NSRC and
its programs, contact:

National Science Resources Center

Arts and Industries Building
Room 1201
Smithsonian Institution
Washington, DC 20560
Telephone: (202)357-2555
Facsimile: (202)786-2028

Chemical and Industries Building, Room 4201
Washington, DC 20560
Telephone: (202) 357-2555
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NSRC

Non-Solvent Resistant Coatings

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APPENDIX B

**NSRC "SCIENCE FOR CHILDREN: AN AGENDA FOR ACTION"
BROCHURE**

Science for Children

An Agenda for Action

NSRC

National Science Resources Center
Smithsonian Institution—National Academy of
Sciences

The NSRC sponsored a National Conference on the Teaching of Science in Elementary Schools in July 1986. This conference brought together over one hundred science educators, teachers, scientists, and science museum directors to share their perspectives and experience. The recommendations that emerged from this conference provide a framework for reforming the teaching of science in elementary schools:

- Participatory activities should be at the center of an elementary science program.
- A number of exemplary activity-based elementary school science programs exist in school systems throughout the nation. Many of these have been identified by the National Science Teachers Association's *Search for Excellence in Science Education*.
- Activity-based elementary science programs are operating successfully in a variety of school settings. Hands-on science programs can be implemented in both large and small school systems, can be successful in inner-city as well as suburban and rural settings, and can be operated with a modest allocation of school system resources.
- Most successful hands-on elementary science programs are based on a series of modular units. Each module includes the

instructional materials and apparatus needed to investigate a particular science topic, plus clearly defined lesson plans for six to eight weeks of student activities.

- The school systems with exemplary elementary science programs usually do not limit themselves to the materials developed by any one national elementary science project, but instead use an eclectic approach to develop a science curriculum that includes a variety of nationally and locally produced units.
- Creative, well-prepared teachers are the most important element of an effective elementary science program. Because most elementary school teachers have limited backgrounds in science, carefully designed inservice education programs are essential.
- Inservice programs can be most effectively structured around a series of teacher workshops, each targeted at a specific science curriculum unit. These workshops need to be offered every year for new teachers and for teachers who have changed grade levels.
- Elementary science instructional materials need to be relatively easy for teachers to use and not require large amounts of teacher preparation time. Many of the school systems with exemplary elementary science programs have restructured

the original NSF elementary science project materials to provide lesson plans in a format more appropriate to the needs of the average teacher.

- Elementary school teachers will spend more time teaching science if science activities emphasize the development of skills that are important in other areas of the curriculum, such as writing, reading, applied mathematics, and artistic expression.
- Elementary school principals need to be actively involved in school system science program improvement efforts. Because many school systems do not have science supervisors, principals need to develop skills that will enable them to provide instructional leadership in science.
- A successful activity-based elementary science program also requires the establishment of an effective science materials support system. Costs can be minimized if the modular science kits that are provided to schools are refurbished after each use and circulated to more than one class each year.
- Science museums can make a significant contribution to the improvement of science teaching in elementary schools. A number have begun to develop elementary science activity units, organize inservice training workshops for teachers,

and provide science kits for elementary school teachers to use in their classrooms.

- Businesses and industrial corporations can play an important role in improving the quality of elementary science teaching in their local communities. They can create an incentive for the school system to improve its elementary science program by providing financial support for hands-on science materials and for in-service training programs.

- There is widespread concern that standardized achievement tests do not do a good job of assessing what students learn in elementary school science. There is a need to develop improved tests and alternative evaluation techniques to assess student progress in science, with more emphasis on the development of scientific attitudes and problem-solving skills.

- A key issue that needs to be addressed is how the number of exemplary elementary science programs throughout the nation may be increased. Only one percent of the elementary school children in the United States are now participating regularly in an activity-based elementary science program. A realistic goal for the next five years would be to increase this figure to ten percent.

The NSRC is establishing a nationwide network to assist school systems and teachers

that are working to improve the teaching of science in elementary schools. For more information, please write to:

National Science Resources Center
Smithsonian Institution, MRC 502
Washington, DC 20560
(202) 287-2063

APPENDIX C

INFORMATION ABOUT HANDS-ON ELEMENTARY SCIENCE UNITS

Science and Technology for Children

Hands-on Science Units for
the Elementary School Curriculum



National Science Resources Center

Smithsonian Institution–National Academy of Sciences



Science and Technology for Children

Hands-on science teaching units for the elementary curriculum

The STC units are:

- **Hands-on**—that's the best way for children to learn science.
- **Modular**—can be integrated into an existing program or used to construct a complete science curriculum.
- **Affordable**—only inexpensive and easily replaced materials and apparatus are used.
- **Tested and reviewed**—nationally field-tested in diverse school systems and reviewed by prominent scientists and educators.
- **Age appropriate**—children engage in activities and learn important science concepts and skills appropriate to their developmental level.
- **Integrated across curricula**—the learning of sciences is integrated with mathematics, language arts, and social studies.

The National Science Resources Center (NSRC), cooperatively sponsored by the Smithsonian Institution and the National Academy of Sciences, has initiated a unique elementary science curriculum development project: Science and Technology for Children (STC).

The project is providing teachers and children with inquiry-based curricular components or units that build on young children's curiosity about the world around them.

Under development are 24 hands-on units for grades 1 through 6. The units can be integrated into an existing program or be used to

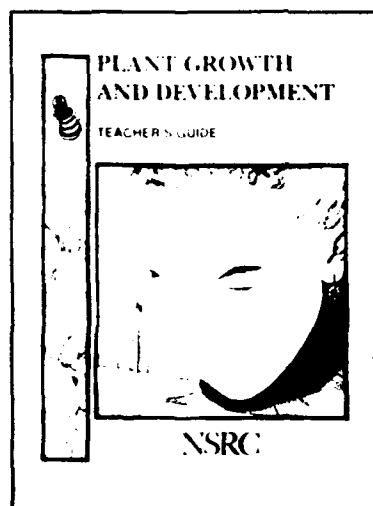
construct a complete science curriculum to provide children the opportunity to learn about topics in the life, earth, and physical sciences, and technology. The units encourage participatory learning and the integration of science with mathematics, language arts, social studies, and art.

A unit consists of lessons for eight weeks of instruction, each requiring about 45 minutes of class time; Teacher's Guide; Student Activity Books; and appropriate supplies and apparatus for a class of up to 30 students. Six units are available now, and seven others are scheduled for release throughout 1992-93.

Sequence and Availability of STC Units

Grade	Life and Earth Science		Physical Science and Technology	
	Organisms Fall 1993	Weather and Me Fall 1992		
	The Life Cycle of Butterflies Available Dec '93	Soils Spring 1994		
	Plant Growth and Development Available Now	Rocks Fall 1994	Chemical Tests Spring 1993	Sounds Fall 1992
	Ourselves Fall 1994	Animal Behavior Fall 1993	Floating and Sinking Fall 1993	Electric Circuits Available Now
	Microworlds Available Now	Ecosystems Spring 1993		
	Experiments with Plants Available Dec '93	It's about Time Spring 1992		

The Teacher's Guide—This clearly written, concise guide is the key to successful use of the STC unit



The STC Teacher's Guides provide teachers with the information they need to conduct successful, hands-on science lessons in the classroom. Each lesson has a set of objectives, step-by-step procedures, and, often, strategies for assessing student learning. There are also relevant content background sections, lists of needed materials, and tips on lesson preparation and lesson management.

STC Teacher's Guides are designed to give teachers the freedom to enhance and extend lessons with their own ideas and to integrate the science content and skills of STC units with the other subjects of the elementary school curriculum.



Students from Watkins Elementary School in Washington, D.C., work with the *Plant Growth and Development* unit.

The Teacher's Guide also includes:

- an overview of the unit—about eight weeks of instruction
- general preparation and management tips
- an annotated list of appropriate science trade books and other print, audiovisual, and software resources for students and teachers
- end-of-unit assessments to evaluate student learning

• numerous illustrations throughout the guide

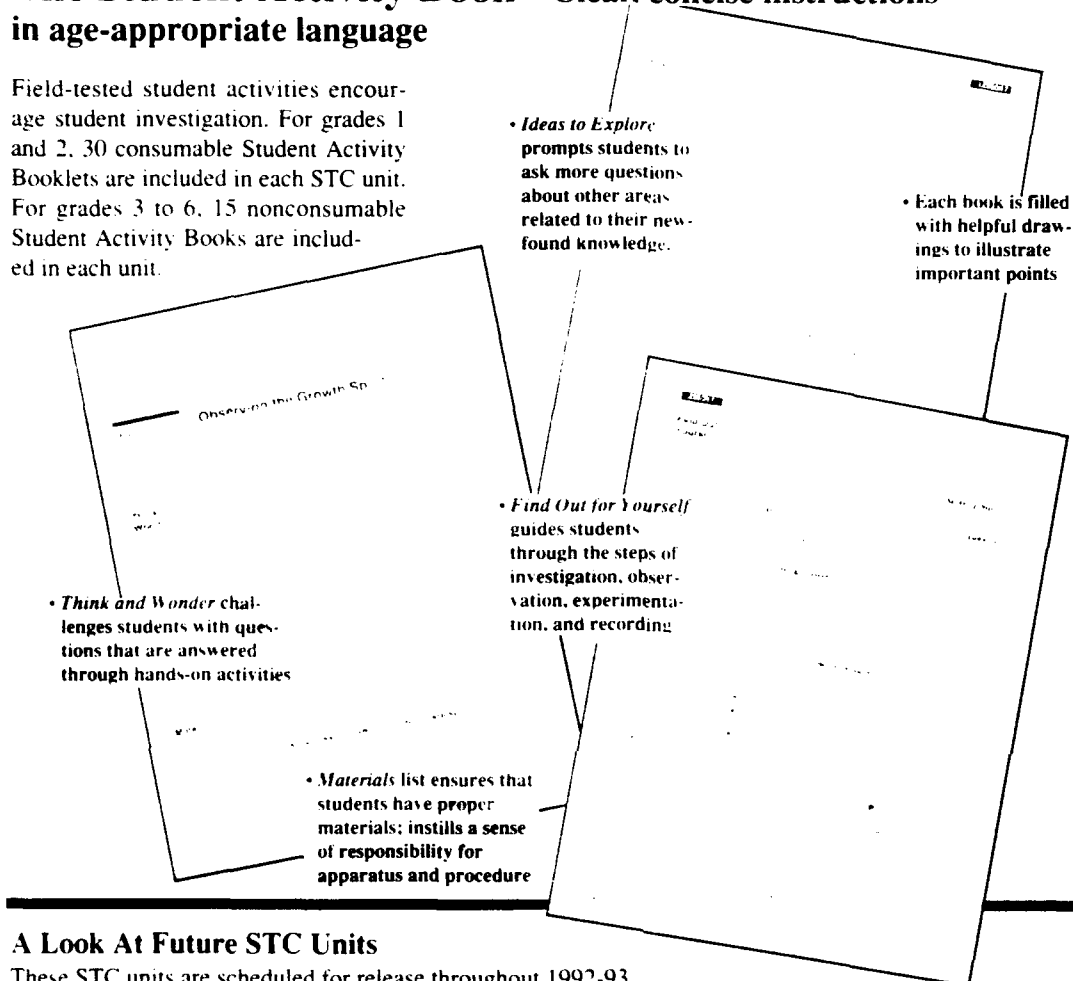
• integrated assessments for monitoring student progress

• for each lesson: overviews, objectives, lists of materials, step-by-step preparation and procedures sections, and extensions

If you have questions or comments about the STC project, call David Middendorf at 919-584-0381, extension 225, or write to him at Science and Technology for Children, Carolina Biological Supply Company, 2700 York Road, Burlington, North Carolina 27215.

The Student Activity Book—Clear, concise instructions in age-appropriate language

Field-tested student activities encourage student investigation. For grades 1 and 2, 30 consumable Student Activity Booklets are included in each STC unit. For grades 3 to 6, 15 nonconsumable Student Activity Books are included in each unit.



A Look At Future STC Units

These STC units are scheduled for release throughout 1992-93

SPRING 1992

FOOD CHEMISTRY. (*Grade 5*) Introduces the basic principles of chemistry and nutrition. Students use chemical tests to detect carbohydrates, fats, and proteins in foods, and discover through a series of readings how these nutrients relate to their health. They learn the value of following procedures carefully to achieve valid results, and of organizing large amounts of data in a systematic way.

IT'S ABOUT TIME. (*Grade 6*) Students participate in activities that parallel the historical development of time-keeping methods; they observe the moon's phases and investigate the movement of the sun's shadows, then build and experiment with such technological innovations as pendulums and mechanical escapements.

FALL 1992

WEATHER AND ME. (*Grade 1*) Introduces students to the concept of weather and how it relates to their everyday world—from the clothes they wear to the weather forecast. Students learn to read a thermometer, estimate wind speed and direction, make and use a simple rain gauge, and recognize cloud patterns.

SOUNDS. (*Grade 3*) Challenges students to question what sound is, and how it is used. Activities highlight sound's readily observable characteristics: pitch, loudness, and vibrations. Through building and experimenting with devices like whistles and model vocal cords, students learn firsthand how humans produce and receive sounds.

SPRING 1993

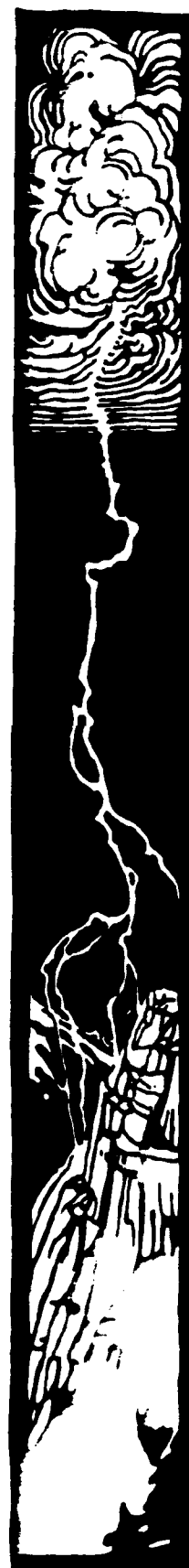
COMPARING AND MEASURING. (*Grade 1*) Introduces students to the processes and skills that form the foundation for standardized measurement: making comparisons, using arbitrary units of measure, and understanding the need for standardized units. Students make and use their own measuring devices to quantify lengths, widths, and heights, as well as to explore volume and capacity.

CHEMICAL TESTS. (*Grade 3*) Introduces some basic principles of chemistry. Students perform simple chemical tests and investigate the properties of similar-looking powders to solve a mystery: what are the identities of the five "unknown" chemicals? They gain practice conducting tests, recording observations, interpreting results, and applying these skills to new situations.

ECOSYSTEMS. (*Grade 5*) Introduces the concept that all living creatures are interdependent. Using plastic soda bottles, students build connecting aquatic and terrestrial environments and observe the interdependence of plants and animals. They then design experiments to investigate the effects of man-made pollutants.

FAX Your STC Order!
919 584-3399

**All our products
are unconditionally
guaranteed!**



Available STC Units

- Six new units for grades 1 through 6
- Includes materials and apparatus for a class of 30, plus Teacher's Guide and Student Activity Books
- Units provide lessons for eight weeks of instruction

THE LIFE CYCLE OF BUTTERFLIES (Grade 2)

Introduces the concept of life cycles by using the painted lady butterfly (*Vanessa cardui*). Students learn observational and recording skills and their importance to science. They learn about the caterpillar's basic needs for air, water, food, and shelter, and they observe and record activities such as spinning silk, eating, resting, eliminating waste, and shedding. The chrysalid and adult stages are also observed, with close attention given to development, anatomy, and feeding.

- 97-1501 Unit . . \$95.00
97-1502 Teacher's Guide . . \$9.95
97-1503 Student Activity Booklet . . \$1.10

PLANT GROWTH AND DEVELOPMENT (Grade 3)

This unit features Wisconsin Fast Plants™, *Brassica rapa*, a member of the mustard family. Students follow the complete life cycle (40 days) of *Brassica*, including germination, growth, development of morphological structures, death of the parent plant, seed harvest, and the emergence of new embryonic plants from harvested seed. Activities include planting seed, thinning and transplanting seedlings, pollinating with dried honey bees, harvest and mature seed, and determining yields.

- 97-1901 Unit . . \$195.00
97-1902 Teacher's Guide . . \$9.95
97-1903 Student Activity Book . . \$2.50

SCIENCE FOR CHILDREN: RESOURCES FOR TEACHERS

A 176-page resource guide for elementary school teachers compiled by the National Science Resources Center (NSRC) staff and reviewed and annotated by classroom teachers. It lists, reviews, and provides ordering information for activity-based science curriculum units, books on science teaching, source books of science activities, and science magazines for both elementary teachers and students. Published by the National Academy Press (1988).

- 97-1090 Unit . . \$9.95

ELECTRIC CIRCUITS (Grade 4)

Designed for grade 4, the unit can also be taught at grades 3 and 5. Students are introduced to the properties of electricity as they explore different kinds of circuits, learn about switches, construct flashlights, and discover the properties of diodes. The unit culminates in students wiring a cardboard-box house.

- 97-2601 Unit . . \$295.00
97-2602 Teacher's Guide . . \$9.95
97-2603 Student Activity Book . . \$2.50

MICROWORLDS (Grade 5)

Designed for grade 5, this unit is adaptable for grade 6. The primary objectives are for students to learn how to observe and record their observations by writing and drawing; to learn about the properties of magnifiers; and to become skilled at using hand lenses, microscopes, slides, coverslips, droppers, and other related apparatus. In addition, each student has an opportunity to observe a wide variety of specimens, both living and nonliving, under magnification with a student microscope (included).

- 97-2701 Unit . . \$295.00
97-2702 Teacher's Guide . . \$9.95
97-2703 Student Activity Book . . \$2.50

EXPERIMENTS WITH PLANTS (Grade 6)

This unit features Wisconsin Fast Plants™, *Brassica rapa*. Students learn how to design then conduct a controlled investigative experiment. They learn to identify the key variables that affect the life, health, and reproductive capabilities of *Brassica* and how these variables can be manipulated. Through data collection, measurement, observation, and recording, students discover the effects of manipulating chosen variables on the plants. Activities include planting seed, thinning and transplanting seedlings, pollination, and harvesting.

- 97-3101 Unit . . \$195.00
97-3102 Teacher's Guide . . \$9.95
97-3103 Student Activity Book . . \$2.50

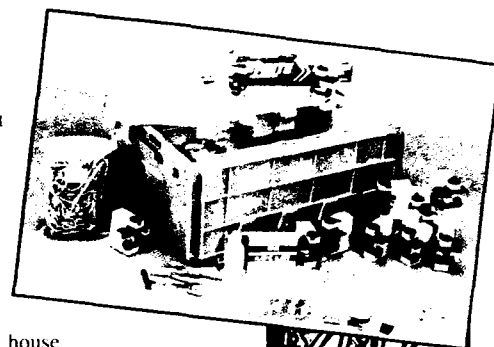
MAGNETS AND MOTORS (Grade 6)

Students explore magnetism and electricity in this unit. Students experiment with magnets and with a compass they make. They discover properties of magnets, and assemble and explore the characteristics of a switch, simple circuits, and electromagnets. Students experiment with three different electric motors, including one they make. Using an electric generator, they produce electricity to light a bulb and make a motor turn.

- 97-3401 Unit . . \$295.00
97-3402 Teacher's Guide . . \$9.95
97-3403 Student Activity Book . . \$2.50

ACT NOW!

**Make STC units a part of your
science curriculum. To order,
Call 800 334-5551 today!**



The most frequently asked questions about Science and Technology for Children:

We are interested in adopting the STC program as part of our curriculum. How can you help us?

If you are planning to adopt a hands-on science curriculum and would be interested in knowing how STC can work for you, we will meet with your curriculum developers, science supervisors, teachers, principals, school board members, and parent organizations to present the total STC program for your consideration. This can be arranged by calling or writing David Middendorf at Carolina Biological Supply Company, 919 584-0381, extension 225.

How can we preview materials?

Any Carolina Biological product—including the STC units—can be ordered on approval for 30 days.

Do you offer workshops, demonstrations, in-service, and pre-service teacher training?

Yes. Each unit is designed to be teacher friendly. Because in-service education is a necessary element of an effective program, we offer hands-on workshops for every unit. We prefer groups of 20 to 30 at a time. This allows interaction between participants similar to that found in the classroom during actual teaching. Complete unit workshops are approximately 3 hours in length. Two workshops can be done in a day.

How much does a workshop cost?

Every situation is different. We want to work with you to provide the training that will make your hands-on program successful. Call David Middendorf at 919 584-0381, extension 225, to discuss your specific needs.

How can we order STC materials?

STC units, printed materials, and apparatus for each unit can be ordered by calling toll free 800 334-5551. The catalog numbers and prices of available materials are included in this brochure.

NSRC | **STC**
National Science Resources Center | Science & Technology for Children



Smithsonian Institution



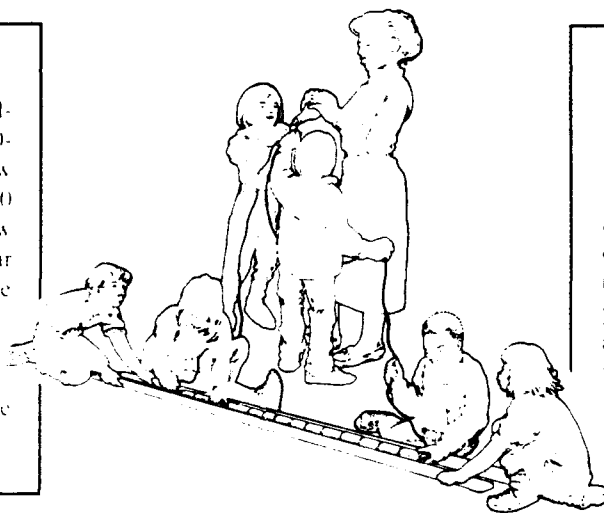
National Academy of Sciences



Carolina Biological Supply Company

Free 30-day Trial

Science and Technology for Children Units are available for a 30-day trial absolutely free. Review any unit in your classroom for 30 days and see for yourself how valuable the material is for your students and your program. At the end of 30 days, if you decide not to purchase, simply write "cancel" on your invoice and return it along with the unit. There is absolutely no obligation.



Your Satisfaction is Unconditionally Guaranteed

All units in the Science and Technology for Children series are unconditionally guaranteed. If you are dissatisfied with any unit, simply return it with a note to that effect for a replacement, full credit, or a refund.



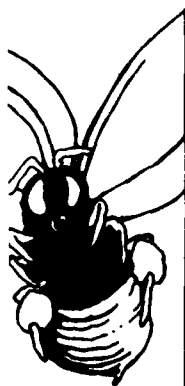
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Science and Technology for Children

The National Science Resources Center—NSRC—is committed to improving the teaching of science in the nation's schools. As part of that commitment, the NSRC is developing a new elementary science program for grades 1-6: SCIENCE AND TECHNOLOGY FOR CHILDREN—STC.

The STC program is based on the principle that children learn science by *doing* science. The curriculum units that make up the STC program are designed to involve children in hands-on investigations of scientific phenomena.

Twenty-four innovative curriculum units—four for each grade level—are being produced by the NSRC under the joint sponsorship of the Smithsonian Institution and the National Academy of Sciences. Developed in cooperation with school districts across the country, the STC units make science meaningful for students and manageable for teachers.

"We cannot afford to miss the opportunity to improve elementary science education. We must put good science instructional materials in teachers' hands from the start."

Robert McC. Adams
Secretary
Smithsonian Institution



**DEVELOPED TO TEACH ALL CHILDREN
SCIENCE CONCEPTS AND SKILLS**

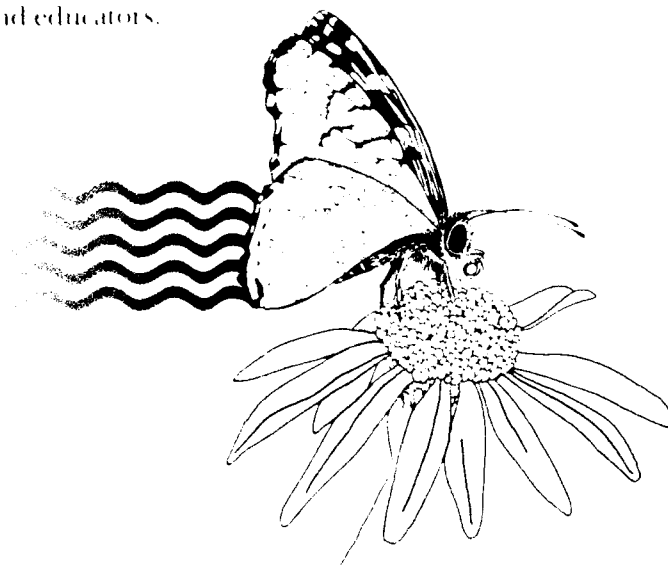
STC units are designed to provide *all* students with stimulating experiences in the life, earth, and physical sciences, and technology while simultaneously developing their critical thinking and problem solving skills.

Built around four central themes, the STC units provide children with the opportunity to learn age-appropriate concepts and skills. In the primary grades, children begin their study of science by observing and measuring, and move on through a progression of experiences, culminating in grade six with the design of controlled experiments.

BASED ON RESEARCH AND TESTING

The design of the STC program is based on research that shows students learn more science through hands-on activities than through rote memorization of technical terms. The units give students opportunities to make their own discoveries in order to develop an increased understanding of important scientific concepts and positive attitudes toward science.

The units are field-tested in inner city, suburban, and rural classrooms across the nation and reviewed by prominent scientists and educators.



DESIGNED TO ASSESS AND INTEGRATE LEARNING

The STC units provide teachers with a variety of strategies to assess student learning in a hands-on science program. STC units also offer teachers opportunities to link the teaching of science with the development of skills in mathematics, language arts and social studies. In addition, STC units encourage the use of cooperative learning teams, so that students can develop the valuable skill of working together in groups.

ORGANIZED AS A MODULAR, FLEXIBLE PROGRAM

The modular design of the STC curriculum makes it possible for school districts to incorporate the units into a variety of curriculum frameworks. STC science units also are designed to be used by students and teachers from a variety of backgrounds and school settings.

SCIENCE AND TECHNOLOGY FOR CHILDREN: CENTRAL THEMES OF UNITS

Central Themes	Grade Levels					
	1	2	3	4	5	6
Observing, Measuring, and Identifying Properties						
Seeking Evidence Recognizing Patterns and Cycles						
Identifying Cause and Effect Extending the Senses						
Designing and Conducting Experiments						

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SCIENCE AND TECHNOLOGY FOR CHILDREN: SEQUENCE OF UNITS AND AVAILABILITY

Grade	Life and Earth Science	Physical Science and Technology		
1	Organisms <i>Fall 93</i>	Weather and Me <i>Fall 92</i>	Comparing and Measuring <i>Spring 93</i>	Observing and Classifying <i>Spring 94</i>
2	The Life Cycle of Butterflies <i>Fall 91</i>	Soils <i>Spring 94</i>	Balancing and Weighing <i>Fall 93</i>	Changes <i>Fall 94</i>
3	Plant Growth and Development <i>Spring 91</i>	Rocks <i>Fall 94</i>	Chemical Tests <i>Spring 93</i>	Sounds <i>Fall 92</i>
4	Ourselves <i>Fall 94</i>	Animal Behavior <i>Fall 93</i>	Floating and Sinking <i>Fall 93</i>	Electric Circuits <i>Spring 91</i>
5	Microworlds <i>Spring 91</i>	Ecosystems <i>Spring 93</i>	Food Chemistry <i>Spring 92</i>	Structures <i>Spring 94</i>
6	Experiments with Plants <i>Fall 91</i>	It's about Time <i>Spring 92</i>	Machines and Inventions <i>Fall 94</i>	Magnets and Motors <i>Fall 91</i>

DESIGNED TO BE AFFORDABLE AND MANAGEABLE

The STC units are affordable, manageable in the classroom, and easily maintained by school districts for repeated use. Each STC unit consists of approximately 16 lessons, or 8 weeks of instruction. Everything a teacher needs—teacher's guide, a set of student activity books, and classroom science materials—is contained in each unit. The teacher's guide is filled with suggestions that help teachers anticipate many classroom situations. Supplemental information provides ideas about how to incorporate computer software, audio-visual materials, and science trade books with the units.



SCIENCE AND TECHNOLOGY FOR CHILDREN UNIT COMPONENTS

- Teacher's Guide
- Set of Student Activity Books
- Kit of Materials and Apparatus
- Recommendations for Supplementary Materials
 - Science Reading Materials
 - Computer Software
 - Audio-visual Materials

Entire units are available or teacher's guides and student activity books may be purchased separately.

UNITS AVAILABLE NOW

- Plant Growth and Development—grade 3
- Electric Circuits—grade 4
- Microworlds—grade 5
- The Life Cycle of Butterflies—grade 2
- Experiments with Plants—grade 6
- Magnets and Motors—grade 6

UNITS AVAILABLE SPRING 1992

- Food Chemistry—grade 5
- It's about Time—grade 6

TO ORDER, WRITE OR CALL:

David Middendorf
Carolina Biological Supply Company
2700 York Road
Burlington, NC, 27215
1-919-584-0381, ext. 225.





"We must begin early by providing children with a challenging and stimulating introduction to science in the elementary grades— a hands-on experience that will give them a taste of real science and build an appetite for more."

Frank Press
President
National Academy of Sciences



The National Science Resources Center was established by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. Located in the Smithsonian Institution Arts and Industries Building in Washington, DC, the NSRC maintains a collection and database of teaching resources, develops science curriculum materials, and sponsors outreach activities to help school districts improve their science programs.

For further information about the STC project and NSRC activities,

**contact: National Science Resources Center
 Smithsonian Institution
 Arts & Industries Building • Room 1201
 Washington, DC 20560
 202-357-2555 FAX 202-786-2028**

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Science and Technology for Children

**A National Elementary Science Curriculum Program
to Improve the Teaching of Science in the
Nation's Elementary Schools**

Introduction

Science and Technology for Children (STC) is a unique elementary science curriculum development project of the National Science Resources Center (NSRC). The STC project is designed to build upon the experience acquired by school districts that have established effective hands-on elementary science programs over the past two decades; the knowledge of the elementary science curriculum materials produced in the past with National Science Foundation support; and the NSRC's four years of experience in developing, publishing, and disseminating inquiry-centered elementary science materials.

The STC project incorporates a thoroughly tested materials-development process that ensures that the hands-on curriculum units produced are scientifically accurate and pedagogically appropriate for children and teachers. The steps of this process include development of a trial-teaching sequence of classroom activities and preparation of trial editions of the science readers, in consultation with teachers and scientists; trial teaching of these materials with children in the District of Columbia Public Schools; national field testing with ethnically diverse groups of children and teachers from urban, rural, and suburban school districts; formative evaluation of the materials by the Program Evaluation and Research Group of Lesley College in Cambridge, Massachusetts; review by an advisory panel of prominent teachers, scientists, educators, and authors of children's science trade books; revision of the materials based on the information obtained from the field-testing process and from the review by the STC Advisory Panel (see list of STC Advisory Panel on page 3); commercial publication by Carolina Biological Supply Company; and dissemination of the materials by Carolina Biological Supply Company and a nationwide program of outreach activities to help school districts effectively implement the STC program.

The project is staffed by people whose experience in elementary science education includes classroom teaching, developing inquiry-centered science curriculum materials, conducting teacher in-service education programs, evaluating science learning, disseminating educational materials nationwide, and providing technical assistance to school districts throughout the country.

Science and Technology for Children is directed by the NSRC, which is sponsored jointly by the National Academy of Sciences and the Smithsonian Institution. The NSRC's commitment and capacity to improve science teaching for our nation's youth, coupled with the resources and support of its sponsoring institutions, provide the STC project with the credibility and visibility needed to produce an effective and engaging science program and disseminate it to elementary school teachers and children throughout the country.

STC Advisory Panel

- Peter Afferbach, Director, The Reading Clinic; Associate Professor, Curriculum and Instruction, University of Maryland, College Park, Maryland
- David Babcock, Director, Board of Cooperative Educational Services, Second Supervisory District, Monroe-Orleans Counties, Spencerport, New York.
- Judi Backman, Math/Science Coordinator, Highline Public Schools, Seattle, Washington
- Albert Baez, President, Vivamos Mejor/USA; and former Director of the Division of Science Teaching, UNESCO, Greenbrae, California
- Andrew R. Barron, Assistant Professor of Chemistry, Harvard University, Cambridge, Massachusetts
- DeAnna Banks Beane, Project Director, YouthALIVE, Association of Science-Technology Centers, former Director of Education, National Urban Coalition, Washington, D.C.
- Al Buccino, Dean, College of Education, University of Georgia, Athens, Georgia
- Audrey Champagne, Professor of Science Education, School of Education, State University of New York at Albany, Albany, New York
- Sally Crissman, Head, Lower School, Shady Hill School, Cambridge, Massachusetts
- Gregory Crosby, Associate Director, Triangle Coalition for Science and Technology Education, Washington, D.C.
- JoAnn E. DeMaria, Teacher, Hutchison Elementary School, Herndon, Virginia
- Hubert Dyasi, Director, Workshop Center for Open Education, City College of New York, New York, New York
- Timothy H. Goldsmith, Professor of Biology, Yale University, New Haven, Connecticut
- Charles Hardy, Assistant Superintendent, Instruction and Curriculum, Highline Public Schools, Seattle, Washington
- Patricia A. Jacobberger, Geologist, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
- Patricia Lauber, Author, Weston, Connecticut
- John Layman, Professor of Physics, University of Maryland, College Park, Maryland
- Sally Love, Museum Specialist, National Museum of Natural History, Smithsonian Institution, Washington, D.C.
- Phyllis Marcuccio, Assistant Executive Director of Publications, National Science Teachers Association, Arlington, VA
- Lynn Margulis, Professor of Biology, University of Massachusetts, Amherst, Massachusetts
- Margo A. Mastropieri, Co-director, Mainstreaming Handicapped Students in Science Project, Purdue University, West Lafayette, Indiana
- Richard McQueen, Specialist, Science Education, Multnomah Education Service District, Portland, Oregon
- Alan Mehler, Professor, Department of Biochemistry, College of Medicine, Howard University, Washington, D.C.
- Philip Morrison, Professor Emeritus of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts
- Phylis Morrison, Author, Cambridge, Massachusetts
- Fran Nankin, Editor, *SuperScience Red*, Scholastic, New York, New York
- Jerome Pine, Professor of Physics, California Institute of Technology, Pasadena, California
- Harold Pratt, Executive Director of Science and Technology, Jefferson County Public Schools, Golden, Colorado
- Wayne Ransom, Vice President for Education, Franklin Institute, Philadelphia, Pennsylvania
- David Reuther, Editor-in-chief and Vice-President, William Morrow Books, New York, New York
- Robert Ridky, Professor of Geology, University of Maryland, College Park, Maryland
- F. James Rutherford, Chief Education Officer and Director, Project 2061, American Association for the Advancement of Science, Washington, D.C.
- David Savage, Teacher, Chevy Chase Elementary School, Montgomery County Public Schools, Chevy Chase, Maryland
- Thomas E. Scruggs, Co-director, Mainstreaming Handicapped Students in Science Project, Purdue University, West Lafayette, Indiana
- Larry Small, Science/Health Coordinator, Schaumburg School District 54, Schaumburg, Illinois
- Michelle Smith, Publications Coordinator, Office of Elementary and Secondary Education, Smithsonian Institution, Washington, D.C.
- Susan Sprague, Director of Science and Social Studies, Mesa Public Schools, Mesa, Arizona
- Arthur Sussman, Science and Health Education Partnership, University of California at San Francisco, San Francisco, California
- Emma Walton, Science Supervisor, Anchorage School District, and Past President, National Science Supervisors Association, Anchorage, Alaska
- Paul Williams, Professor of Plant Pathology, University of Wisconsin at Madison, Madison, Wisconsin
- Kathryn Wolff, Managing Editor, American Association for the Advancement of Science, Washington, D.C.

Philosophy and Goals

The Science and Technology for Children (STC) program is based on the principle that children learn science best in an experiential environment where they can investigate science phenomena using concrete materials such as pendulums, balances, electrical circuits, simple microscopes, plants, and animals. An inquiry-centered elementary science program, based on hands-on instructional units, enables young children to learn about the essence of science by asking questions and working to find the answers to these questions. This approach to science instruction captures children's curiosity, stimulates their interest in science, and teaches them important science concepts as well as the critical-thinking skills involved in scientific problem-solving. A hands-on, inquiry-oriented approach to learning science is also consonant with a constructivist learning model that emphasizes student-centered activity and the logic of a student's own experiences.

The STC program consists of a series of 24 inquiry-centered curriculum units that have been carefully designed to involve children in hands-on investigations of scientific phenomena, enabling them to make their own discoveries about the world of science. Through investigation and discovery, children learn developmentally appropriate concepts that are central to the life, earth, and physical sciences and technology. The key concepts of the 24 units of the STC program are reflected in the unit titles (see Table 1 on page 6).

The STC program places considerable emphasis on the development of scientific reasoning skills. In the primary grade units, children begin their study of science by observing and measuring, then they move through a progression of experiences that culminate in grade six with the design of controlled experiments, as illustrated in Table 2 on page 7. As a result of this structured sequence, at the end of grade six, students have had the opportunity to develop a number of important critical-thinking skills as well as to have gained an understanding of many scientific phenomena and basic concepts.

The STC program also emphasizes the development of scientific attitudes, especially the scientific "habits of mind" described in the Science for All Americans report of Project 2061 of the American Association for the Advancement of Science.

Science and Technology for Children

Sequence of Unit Topics

Grade	Life and Earth Sciences		Physical Science and Technology	
1	Organisms	Weather and Me	Comparing and Measuring	Observing and Classifying
2	The Life Cycle of Butterflies	Soils	Balancing and Weighing	Changes
3	Plant Growth and Development	Rocks	Chemical Tests	Sounds
4	Ourselves	Animal Studies	Floating and Sinking	Electric Circuits
5	Microworlds	Ecosystems	Food Chemistry	Structures
6	Experiments with Plants	Time	Machines and Inventions	Magnets and Motors

Table 2

Science and Technology for Children

Goals for Student Learning

Development of Conceptual Understanding in Science	Development of Scientific Attitudes and Habits of Mind
<ul style="list-style-type: none"> • The focus will be on concepts that are appropriate to children's level of cognitive development. • Concepts will be stressed that relate to children's everyday experience. • Balance will be maintained between life science, earth science, physical science, and technology. 	<ul style="list-style-type: none"> • Curiosity • Respect for evidence • Critical reflection • Flexibility • Sensitivity to living things

Development of Scientific Reasoning Skills						
Central Themes	Grade Levels					
	1	2	3	4	5	6
Observing, Measuring, and Identifying Properties						
Seeking Evidence/ Recognizing Patterns and Cycles						
Identifying Cause and Effect/ Extending the Senses						
Designing and Conducting Controlled Experiments						

Program Materials Description

The STC's 24 curriculum units are designed for use in grades one through six and can be used as a complete elementary science program or individually, as supplements to an existing program. Each unit contains everything a teacher needs--a comprehensive teacher's guide, a set of student activity books or student notebooks, and a classroom kit of science equipment--to teach the eight-week unit to a class of 30 elementary school students. The teacher's guide and student activity book or notebook are available exclusively through the publisher of the STC program materials. The equipment in the kits also is available for a reasonable cost from the publisher or can be easily and inexpensively assembled and maintained by school districts.

The lessons of the STC units incorporate the "Focus-Explore-Reflect-Apply" learning cycle, using a constructivist approach to learning (see Table 3 on page 10). The teacher's guides also: include suggestions to help teachers anticipate many classroom situations; make use of cooperative learning experiences to teach students how to work in groups; and link the teaching of science with the development of skills in mathematics, language arts, and social studies. Guidelines for the assessment of student learning and test instruments are provided to help teachers assess their students' acquisition of specific science concepts and skills before, during, and after the teaching of the units.

Each lesson in the STC teacher's guides contains a set of objectives, background on relevant science concepts, a list of the required materials, step-by-step procedures, and tips on lesson preparation and lesson management. In addition, the units include ideas on ways to incorporate the use of supplemental materials, such as computer software, audiovisual aids, and science trade books.

The STC student activity books include step-by-step directions that guide students through the unit's investigations. These investigations are designed to focus student thinking on specific scientific phenomena, to assist the development of an intuitive understanding of important science concepts, and to encourage reflection and further research into the phenomena.

The STC student notebooks, currently available for units for grades one and two, contain student activity sheets and are designed for consumable use.

Science and Technology for Children

Learning Cycle

Focus: Explore and clarify the ideas that children already have about the topics

Explore: Enable children to engage in hands-on explorations of the objects, organisms, and science phenomena to be investigated

Reflect: Encourage children to discuss their observations and to reconcile their ideas

Apply: Help children to discuss and apply their new ideas in new situations

**Summaries of Science and Technology for Children
Life, Earth, and Physical Sciences and Technology Units**

FIRST GRADE: Life and Earth Science

Organisms

This unit provides experiences to help young children form their own ideas about living things. Students create and observe a woodland habitat containing Loblolly Pines seedlings, Pillow Moss, Pill Bugs, and Bess Beetles, and a fresh water habitat containing Elodea and Cabomba plants, Pond Snails and Guppies. Sustained by their own curiosity, students discover the ways in which living things are alike and the ways in which they differ. *Here are opportunities for students to refine their sensitivity toward and understanding of the interdependence of life.*

Weather and Me

Here students are introduced to the concept of weather and how the factors governing the weather affect their everyday world, from the clothes they wear to whether it will be sunny or not tomorrow. Students construct and use a variety of tools that help them learn to read thermometers, estimate wind strength, gauge rainfall, and recognize cloud formations. Throughout, students collect and record daily information about temperature, cloud cover, wind, and precipitation.

FIRST GRADE: Physical Science and Technology

Comparing and Measuring

In this unit, students engage in exploration of a variety of preliminary linear and volumetric measuring activities. Interesting activities, such as comparing arm width versus height and measuring how tall the teacher is, provide practice with skills and concepts that will help make measuring meaningful. In addition to making comparisons, students use arbitrary units of measure, and develop standardized units. Self-made measuring devices are used by students to quantify lengths, widths, and heights, and then to explore volume and capacity.

Observing and Classifying

In this unit, students are introduced to observing, classifying, and sorting everyday objects, such as buttons, Attribute Blocks™, and Pattern Blocks™. These activities help students to identify characteristics and attributes of these objects, then they move on to engage in grouping activities based on similarities and differences. Concrete patterning activities help children to see and develop patterns and then to extend their pattern recognition skills to broader applications in problem-solving.

SECOND GRADE: Life and Earth Sciences

The Life Cycle of Butterflies

Children are naturally curious about the growth and development of animals. This unit builds on that interest by enabling young students to investigate the life cycle of the Painted Lady butterfly (*Vanessa carduis*). For eight weeks, the diverse behavior and characteristics of this cosmopolitan insect are observed, recorded, and analyzed. The metamorphoses from caterpillar to chrysalis and, finally, to an adult butterfly are dramatic and punctuate the changes that occur over the life cycle. Students compare the life cycle of this insect to the life cycles of other animals, deepening their knowledge of the diversity of life, patterns that exist within animal life cycles, and the relationships between structures and their functions.

Soils

In this earth science unit, students explore the properties of soil. They collect and observe different types of soil, then use sieves and water settling jars to sort out the different components. Students compare how different types of soil absorb and hold water, and they conduct activities involving erosion. Students also are introduced to some inhabitants of the soil and observe their effect. Finally, students "make" their own soil.

SECOND GRADE: Physical Science and Technology

Balancing and Weighing

This unit introduces young children to the concepts of balancing and weighing. A wide variety of ways to achieve balance is explored, such as making mobiles and balancing objects on a beam. Students then learn to use an equal-arm balance, and they compare and measure the weight of various objects, as well as order the objects according to their weight. Finally, students apply what they have learned about weighing to other activities involving problem-solving.

Changes

This unit provides children with the opportunity to explore the concept of change as it occurs in the parts of natural world with which they are familiar. Living and non-living processes, such as growth and decay, melting and phase changes, are emphasized. Students are encouraged to discuss their ideas about these processes, then to engage in a series of observations and investigations that expose them to new ideas about time-dependent reactions as well as cause and effect.

THIRD GRADE: Life and Earth Sciences

Plant Growth and Development

In this unit, students observe and analyze the growth and development of Wisconsin Fast Plants™ to further their conceptual understanding of life cycles and the interdependence of living organisms. Working in cooperative groups, students germinate seeds, thin and transplant seedlings, pollinate flowers with dried honey bees, harvest mature seeds, and determine the seed yields. As they observe, draw, measure, record, graph, construct models, and communicate their results to their classmates, students improve their skills in the use of the tools of science. Students also increase their knowledge of the characteristics of living organisms and the variety of ways in which they depend on their environment and each other for survival.

Rocks

This unit builds on children's natural curiosity about rocks. After making their own rock collections, students observe the rocks, describe the similarities and differences, and develop a classification system based on physical characteristics. Then they use a rock collection and equipment provided in the unit's kit to conduct tests for some of the properties of rocks, such as color, luster, hardness, streaking color, and weight. Student reading selections relate the rocks that the students observe and classify to the processes by which rocks are formed.

THIRD GRADE: Physical Science and Technology

Chemical Tests

In this unit, students investigate the identities of five common household chemicals. Working in cooperative groups, students investigate the physical properties of the chemicals and perform simple chemical tests to learn what happens when substances change. Solubility, filtration, evaporation, and crystallization are introduced and excite students' interest. Cabbage juice is used as an indicator to introduce the idea of pH. In the latter part of the unit, students encounter a new challenge as they use the powdered chemicals they have now identified to analyze liquid unknowns. Throughout the unit, students observe, record, interpret results, and sharpen their skills as they solve problems in new situations.

Sounds

This unit challenges students to investigate where sound comes from and how it is used. Activities highlight sound's readily observable characteristics: vibrations, pitch, and loudness. Such simple and engaging materials as string, nails, whistles, and membranes are used as students construct and experiment with devices that vibrate in a variety of ways. Using only a magnet and a coil of wire, they also create a simple earphone and then investigate ways to make it louder. In culminating activities, students make model vocal cords and read about how humans produce and receive sound.

FOURTH GRADE: Life and Earth Sciences

Ourselves

This unit helps students explore how their major body systems work together to sustain their health and their ability to do work. Students document their sleeping and waking cycles and examine similar behaviors in other living things. Also investigated and discussed are eating and nutritional needs as well as vision, hearing, lung capacity, temperature control, and other basic behavior. Students determine some of their own learning behaviors and read about our growing understanding of how the brain functions.

After engaging in this unit's various activities, students will have developed an understanding of the unique "machine" that is the human body.

Animal Studies

This unit is designed to help students learn how we acquire reliable information about animals. Students observe two organisms first-hand: guppies and tree frogs. Owl pellets serve as an example of how much can be learned about an animal second-hand.

Students record cumulative data to assist them in making comparisons of the organisms that they have studied and discuss what types of information can be gathered through observation, experimentation, and research.

FOURTH GRADE: Physical Science and Technology

Floating and Sinking

In this unit, students engage in activities that give them experience with interesting, easily observable, and challenging phenomena involving floating and sinking. Measuring tools, such as a spring scale, are used to investigate the buoyant force on a variety of objects. Clay and aluminum foil boats are constructed, and students are challenged to increase the boats' capacity for supporting cargo. Students also construct a hydrometer to help them make observations about the buoyant characteristics of liquids other than fresh water. Throughout, students are challenged to use their ideas to make and test predictions with experimental apparatus.

Electric Circuits

This unit introduces students to the properties of electricity and how it works as well as how we use it. Students explore different kinds of circuits, learn about switches, construct flashlights, and discover the properties of diodes. In the culminating activity, students wire a cardboard-box house—an enjoyable activity that also demonstrates to the teacher how much has been learned.

FIFTH GRADE: Life and Earth Science

Microworlds

This unit offers students experience in the use of hand lenses and simple microscopes while investigating representatives of microscopic life. They discover the properties of lenses and become skilled in making slides and using microscopes as observation tools. Through their investigations, students are able to see cells and they learn about the diversity of characteristics that can be seen in organisms when viewed under different powers of magnification.

Ecosystems

This unit introduces students to the concept of communities of animals and plants, to habitats, and to observable aspects of interdependence. Students work with a terrarium containing plants, soil, and live insects and an aquarium containing plants, snails, and guppies. After studying these environments, they conduct experiments to study the result of overfertilization, excess salt, and acid rain. Through a series of readings and case studies about the Chesapeake Bay area, they grapple with the problems and trade-offs involved in trying to solve ecological problems.

FIFTH GRADE: Physical Science and Technology

Food Chemistry

This unit builds on the *Chemical Tests* unit as students work with food and nutrition to learn more about what matter is and what its properties are. Students use chemical tests to detect carbohydrates, fats, and proteins in foods, learning more about what happens when substances change. Through a series of readings, students discover how the nutrients they test for and others, such as vitamins, relate to their health. They also learn to organize large amounts of data in a systematic way and to handle variations in experimental results.

Structures

This unit challenges students to design, construct, and evaluate a variety of structures. Students experiment with materials such as toothpicks, straws, paper, and aluminum foil. Through their investigations, students develop an understanding of the concepts of strength, directionality, and rigidity and how these concepts apply to real structures in their environment.

SIXTH GRADE: Life and Earth Science

Experiments with Plants

In the *Experiments with Plants* unit, students apply the knowledge and skills they have gained in earlier grades from STC life sciences units to investigate some of the variables that affect the life, health, and reproductive behavior of the Wisconsin Fast Plant™ (*Brassica rapa*). In this advanced unit, lessons are structured to help students learn how to set up and execute controlled experiments. In teams, students formulate a question to investigate through an experiment involving one variable, such as fertilizer or light. During the next five weeks students observe and record their experiments with drawings, written descriptions, and measurements, discovering the effects that manipulating variables has on the plants. Through these experiments, students continue to increase their knowledge about concepts related to energy, interdependence, diversity of life, and evolution.

Time

As a unit about the science, technology, and history of measuring time, *Time* enables students to examine their ideas about time and to investigate ways of measuring time. First, much like early humans, students use some of nature's cycles, those of the sun and moon, as timekeepers. In the course of these activities students make independent observations of the moon's phases and analyze why they are useful for timekeeping. In the second part of the unit students create and experiment with a water clock. Then they build and experiment with mechanical clock works, including a pendulum and a complete escapement mechanism. As they work through the unit, students build on their knowledge of time, motion, machines, energy, and astronomy. In addition, they gain experience in using the processes of science by observing phenomena, recording their observations, gathering data, planning and conducting experiments, plotting and reading graphs, and discussing their findings with peers.

SIXTH GRADE: Physical Science and Technology

Machines and Inventions

This unit enables students to draw on their prior experiences to investigate the characteristics of simple machines and the physical interaction of objects. Students develop a plan and construct devices of their own design, based on their investigations of motion and forces. Reading selections reveal some interesting aspects of past inventions and explore the way ideas can lead to patents and products.

Magnets and Motors

In this unit, students build on the knowledge and skills they gained earlier in the *Electric Circuits* unit. They discover properties of magnets and the magnetic properties of electric currents, construct a compass, and assemble three increasingly complex electric motors. In the process, they learn about some forms of energy and the changes that occur as energy is used. In a culminating activity, students use an electric generator to light a bulb and to make a motor turn, learning some of the practical applications of electricity and magnetism.

National Science Resources Center

The National Science Resources Center (NSRC) is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, D.C.

The National Academy of Sciences and the Smithsonian Institution provide oversight of NSRC programs and operations. The NSRC Advisory Board, which includes scientists, executives from major U.S. corporations, and educational leaders from across the country, helps set priorities for the center's programs and activities. The Board also reviews and approves an annual program plan for the center, assists in reviewing resource materials produced by the center, and helps the center in its fund-raising activities. (See listing of NSRC Advisory Board members on the next page.)

The NSRC staff comprises twenty-six full-time professionals and support personnel: two are supported by Smithsonian trust funds; four by the Smithsonian Federal budget; and twenty by National Academy of Sciences project grants. In addition to its core staff, the NSRC draws on an extensive network of consulting scholars and practitioners. The NSRC has received grants and contracts from a number of United States government agencies, philanthropic foundations, and corporations. Sponsors of NSRC programs are as follows.

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Martha A. Darling, Manager, Government Policy, Boeing Commercial Airplane Group, Seattle, Washington
Hubert Dyasi, Director, Workshop Center for Open Education, City College of New York, New York, New York
James Ebert, Vice President, National Academy of Sciences, Washington, D.C.; Director, Chesapeake Bay Institute, Johns Hopkins University, Baltimore, Maryland
Douglas E. Evelyn, Deputy Director, National Museum of American History, Smithsonian Institution, Washington, D.C.
Samuel Fuller, Vice President, Corporate Research, Digital Equipment Corporation, Maynard, Massachusetts
Charles Hardy, Assistant Superintendent, Instruction and Curriculum, Highline School District, Seattle, Washington
Martin Harwit, Director, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
Robert M. Hazen, Staff Scientist, Carnegie Institution of Washington, D.C.
Robert Hoffmann, Assistant Secretary for Research, Smithsonian Institution, Washington, D.C.
Ann Kahn, Director, Organizational Liaison, Mathematical Sciences Education Board, National Research Council, Washington, D.C.
Manert Kennedy, Executive Director, Colorado Alliance for Science, University of Colorado, Boulder, Colorado
Sarah A. Lindsey, Science Coordinator, Midland Public Schools, Midland, Michigan
Thomas Lovejoy, Assistant Secretary for External Affairs, Smithsonian Institution, Washington, D.C.
William J. McCune, Jr., Chairman, Polaroid Corporation, Cambridge, Massachusetts
Phyllis Marcuccio, Assistant Executive Director for Publications, National Science Teachers Association, Washington, D.C.
Lynn Margulis, Professor of Biology, University of Massachusetts, Amherst, Massachusetts
Philip Morrison, Professor of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts
Phyllis Morrison, Author, Cambridge, Massachusetts
Philip Needleman, Corporate Vice President, Research and Development, and Chief Scientist, Monsanto Company, St. Louis, Missouri
Jerome Pine, Professor of Physics, California Institute of Technology, Pasadena, California
Wayne Ransom, Vice President for Education, Franklin Institute, Philadelphia, Pennsylvania
Peter Raven, Director, Missouri Botanical Garden, St. Louis, Missouri
Lynne Strieb, Elementary School Teacher, Greenfield School, Philadelphia Public Schools, Philadelphia, Pennsylvania
Melvin Webb, Dean, School of Education, Clark Atlanta University, Atlanta, Georgia
Karen Worth, Faculty, Wheelock College, Boston, Massachusetts; Principal Investigator, Urban Elementary Science Project, Education Development Center, Newton, Massachusetts

Ex Officio Members

James Early, Assistant Secretary for Public Service, Smithsonian Institution, Washington, D.C.
Philip Smith, Executive Officer, National Academy of Sciences, Washington, D.C.

APPENDIX D

**NSRC ELEMENTARY SCIENCE LEADERSHIP
INSTITUTE INFORMATION**

Elementary Science Leadership Institutes



NSRC



National Science Resources Center

SMITHSONIAN INSTITUTION • NATIONAL ACADEMY OF SCIENCES

NSRC Elementary Science Leadership Institutes

Developing the scientific and technological literacy of all students is critical to our nation's future, and should begin in the primary grades. Children can come to know and understand science best through hands-on experiences which enable them to work and think like scientists. In this way, they can learn to observe, record, pose questions, design experiments, and solve problems, thereby developing critical thinking skills that will serve them throughout their lives.

The implementation of effective, district-wide, hands-on elementary science programs requires informed leadership. To help develop this leadership, the NSRC conducts summer Elementary Science Leadership Institutes. Each institute prepares teams of administrators, curriculum specialists, teachers, and scientists to design and implement hands-on science programs for their school districts.

Institute participants enhance their leadership skills by engaging in workshops and discussions on

- Science curriculum units appropriate for children in grades one through six;

- In-service education programs to prepare elementary school teachers to teach hands-on science;

- Support systems for supplying hands-on science materials and apparatus to elementary school teachers;

- Assessment methods for evaluating student performance that are consistent with the goals of a hands-on elementary science program;

- Interdisciplinary approaches for integrating science instruction with other curricula; and

- Strategies for building administrative and community support for a hands-on elementary science program.



SMITHSONIAN INSTITUTION



NATIONAL ACADEMY OF SCIENCES

School districts applying for participation in the institutes are asked to identify a four-person leadership team. The team will be expected to develop a comprehensive plan to improve the elementary science program in their district through the use of hands-on curriculum units that foster experimentation and inquiry. The team should be carefully chosen to include recognized district leaders who are strongly committed to hands-on science instruction.

Each team should be comprised of

- A superintendent of schools or an assistant superintendent for curriculum and instruction;

- A science coordinator, a director of curriculum and instruction, or a director of elementary education;

- An experienced classroom teacher who has demonstrated leadership in his or her school and in the district-at-large; and

- A scientist from an industrial corporation, federal research facility, college, or university.

The Leadership Institute staff will include leading science educators, teachers, scientists, and school district personnel who have implemented exemplary hands-on elementary science programs.

The NSRC Elementary Science Leadership Institutes are held at the S. Dillon Ripley Center of the Smithsonian Institution in Washington, D.C.

Interested school districts may request applications from the NSRC. Applications received by April 1 will be considered for that summer's institutes. Applications will be reviewed by a screening committee. The selection of school districts will be based on the following criteria:

- Clarity in identifying elementary science program needs;

- Nature of plans to implement a hands-on elementary science program;

- Evidence of commitment to provide the resources needed for a hands-on elementary science program; and

- Breadth of school district participation as represented by leadership team members.

In addition, the NSRC strives to include in each summer institute a broad mix of school districts that serve culturally diverse student populations.

The NSRC will provide accommodations for all participants. In addition, the NSRC will provide continental breakfast and lunch each day, as well as two evening meals.

School districts are responsible for the transportation expenses of team members and a team registration fee of \$100. The registration fee is due June 1 and is not refundable.

For applications and information, please contact

Olive Covington, Director of Outreach

National Science Resources Center

Arts and Industries Building, Room 1201

Smithsonian Institution

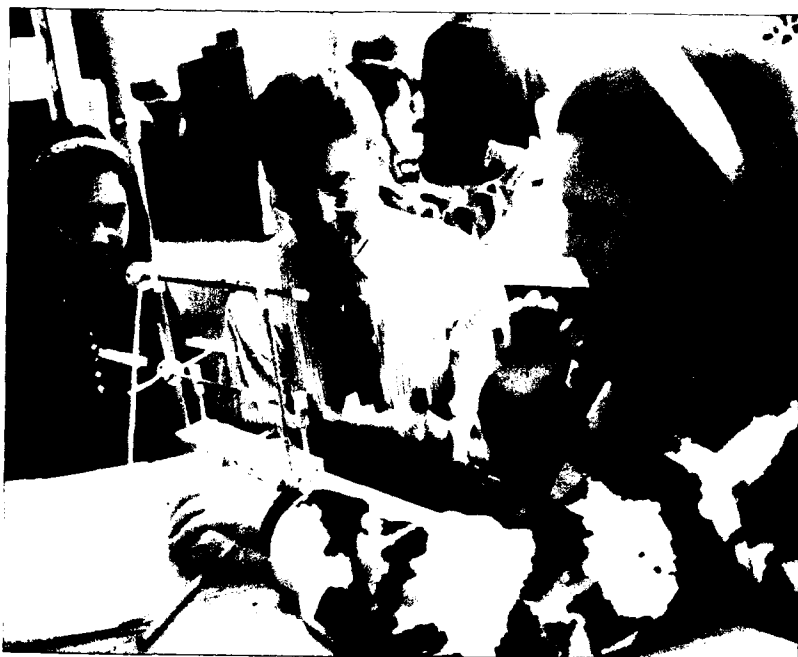
Washington, DC 20560

Telephone: (202) 357-2555; Facsimile: (202) 786-2028

NSRC

National Science Resources Center

The National Science Resources Center is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, D.C.



Amoco Foundation
Digital Equipment Corporation
Dow Chemical Company
Foundation
E. I. du Pont de Nemours and
Company
Hewlett-Packard Company
John D. and Catherine T.
MacArthur Foundation

National Science Foundation
U.S. Department of Defense
U.S. Department of Education
The W. K. Kellogg Foundation
Endowment of the National
Academy of Sciences and the
Institute of Medicine

Smithsonian Institution
National Science Resources Center
Arts and Industries Building, Room 1201
Washington, DC 20560

Official Business Penalty for Private Use, \$300



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**NSRC Elementary Science
Leadership Institutes**
An Opportunity for Your School District

Science for Children



NSRC Elementary Science
Leadership Institute

July 8-12, 1991

National Science Resources Center
Smithsonian Institution - National Academy of Sciences

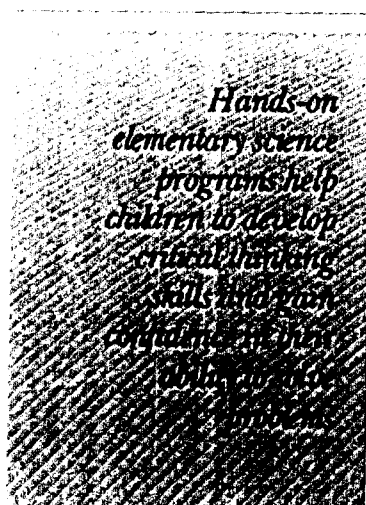
NSRC Elementary Science Leadership Institute

July 8-12, 1991

Developing the scientific and technological literacy of all students is critical to the nation's future, and should begin in the primary grades. In the primary grades, children come to know and understand science best through hands-on experiences, which enable them to work and think like scientists. They learn to observe, record, pose questions, design experiments, and solve problems, thereby developing critical thinking skills that will serve them throughout their lives.

A district-wide hands-on elementary science program requires informed leadership. To help develop this leadership, the NSRC conducts annual leadership institutes. This summer, the NSRC will conduct its third Elementary Science Leadership Institute to prepare fifteen (15) teams of administrators, curriculum specialists, teachers, and scientists to design and implement hands-on science programs for their school districts. Participants will enhance their leadership skills by engaging in workshops and discussions on:

- SCIENCE CURRICULUM UNITS appropriate for grades one through six
- SUPPORT SYSTEMS for supplying hands-on science materials and apparatus to elementary school teachers
- INSERVICE EDUCATION PROGRAMS to prepare elementary teachers to teach hands-on science
- INTERDISCIPLINARY APPROACHES for integrating science instruction with other curricula
- ASSESSMENT METHODS for evaluating student performance that are consistent with the goals of a hands-on elementary science program
- PUBLIC RELATIONS STRATEGIES for building administrative and community support for a hands-on elementary science program





SMITHSONIAN INSTITUTION



NATIONAL ACADEMY OF SCIENCES

Dates and Location

The NSRC Elementary Science Leadership Institute will be held from Monday, July 8, through Friday, July 12, 1991 at the S. Dillon Ripley Center of the Smithsonian Institution in Washington, D.C.

Institute Participants

School districts applying for participation in the Institute will be asked to identify a four-person leadership team. The team will be expected to develop a comprehensive plan to improve the elementary science program in their district through the use of hands-on curriculum units that foster experimentation and critical thinking skills. The team should be carefully chosen. It should consist of recognized district leaders who are strongly committed to a hands-on approach to science learning.

Each team should be comprised of: 1) A superintendent of schools or an assistant superintendent for curriculum and instruction; 2) A science coordinator, director of curriculum and instruction, or a director of elementary education; 3) An experienced classroom teacher who has demonstrated leadership in his or her school and in the district-at-large; and 4) A scientist from an industrial corporation or a local university.

Institute Staff

Institute staff will include NSRC staff, scientists, and leading science educators, among them school district personnel who are experienced in operating exemplary hands-on elementary science programs.

Application Process

Interested school districts should request applications from the NSRC. Completed applications must be returned to the NSRC no later than April 12, 1991. Applications will be reviewed by a screening committee. Selections of school districts will be based on the following criteria: 1) Clarity in identifying elementary science program needs; 2) Current plans to implement a hands-on elementary science program; 3) Evidence of commitment to provide the resources needed for a hands-on elementary science program; and 4) Experience of the leadership team members. Districts that have submitted applications will be notified of their status by May 13, 1991.

Accommodations and Meals

The NSRC will provide accommodations and meals for all participants.

Registration Fee and Travel

School districts will be responsible for the transportation expenses of team members plus a team registration fee of \$400.00. The registration fee is due by June 1, 1991 and is not refundable.

For applications and information, please write or call:

Olive Covington, Director of Outreach
National Science Resources Center
Arts and Industries Building, Room 1201
Smithsonian Institution
Washington, DC 20560
(202) 357-2555

NSRC

National Science Resources Center

The National Science Resources Center was established in 1985 by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science and mathematics in the nation's schools. Located in the Smithsonian Institution's Arts and Industries Building in Washington, D.C., the NSRC maintains a collection and database of teaching resources, develops and disseminates curriculum materials for teachers, and sponsors outreach activities to help school districts improve their science programs.



Sponsor of the 1991 Elementary Science Leadership Institute
Digital Equipment Corporation

Sponsors of NSRC Programs

Amoco
Foundation, Inc.

Digital Equipment
Corporation

The Dow Chemical
Company Foundation

E.I. du Pont
de Nemours and Co.

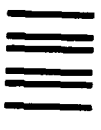
John D. and Catherine T.
MacArthur Foundation

U.S. Department
of Defense

U.S. Department
of Education

Science for Children
National Science Resources Center
Ages & Industries Building, Room 1201
Washington, DC 20560

Official Business Penalty for Private Use \$300



Postage and Fees Paid
Smithsonian Institution
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An Opportunity for Your School District

Science for Children
Elementary Science
Leadership Institute

**The National Science Resources Center (NSRC)
1992 Elementary Science Leadership Institute**

The NSRC will conduct two Institutes in 1992:

June 22 - 26

July 20 - 24

Interested school districts should request an application from the NSRC. Completed applications must be returned to the NSRC no later than March 31, 1992. Districts will be notified of their acceptance by April 24, 1992.

For applications and information, please write or call:

**Olive Covington, Director of Outreach
National Science Resources Center
Arts and Industries Building, Room 1201
Smithsonian Institution
Washington, DC 20560
(202) 357-2555**

1992 NSRC Elementary Science Leadership Institutes

June 22-26, 1992

July 20-24, 1992

The NSRC will conduct two Elementary Science Leadership Institutes in 1992: June 22 - 26 and July 20 - 24. Interested school districts should request an application from the NSRC. Completed applications should be returned to the NSRC no later than April 1, 1992 in order to be considered for this summer's institutes. Districts will be notified of the status of their applications by April 24, 1992.

For applications and information, please contact

Olive Covington, Director of Outreach
National Science Resources Center
Arts and Industries Building, Room 1201
Smithsonian Institution
Washington, D.C. 20560
Telephone: (202) 357-2555
Facsimile: (202) 786-2028

Sponsors of the 1992 Elementary Science Leadership Institutes

National Science Foundation
U.S. Department of Education
Digital Equipment Corporation
Dow Chemical Company Foundation
Hewlett-Packard Company
Carolina Biological Supply Company

NSRC

■ National Science Resources Center

SMITHSONIAN INSTITUTION • NATIONAL ACADEMY OF SCIENCES

National Science Resources Center
Smithsonian Institution–National Academy of Sciences

1992 NSRC Elementary Science Leadership Institute

Application

School District: _____

Superintendent: _____

Address: _____

City: _____ State: _____ ZIP: _____ Telephone: _____

Instructions

In 1992, the National Science Resources Center (NSRC) will conduct two Elementary Science Leadership Institutes at the Smithsonian Institution in Washington, D.C. Institute dates are June 22-26 and July 20-24. Chances of selection are greater if either date is acceptable. Each institute will prepare teams from 15 school districts to design and implement hands-on science programs for their school districts.

Selection of school districts will be based on the following criteria:

- Clarity in identifying elementary science program needs;
- Nature of plans to implement a hands-on elementary science program;
- Evidence of commitment to provide the resources needed for a hands-on elementary science program; and
- Breadth of district-wide participation represented by the leadership team. In addition, the NSRC strives to achieve a broad mix of school districts including those serving culturally diverse student populations.

School districts applying for participation in an institute will need to identify a four-person leadership team. This team will be expected to develop a plan to improve the elementary science program in the district. **Emphasis will be placed on the use of hands-on curriculum units that foster the development of scientific attitudes and problem-solving skills.**

The team should consist of persons who are recognized district leaders and who are committed to a hands-on approach to science learning. It should be composed of:

- a superintendent of schools, or an assistant superintendent for curriculum and/or instruction;
- a science coordinator, director of curriculum and instruction, or a director of elementary education;
- an experienced classroom teacher who has demonstrated leadership in the school building and the district-at-large; and
- a scientist from a local industrial corporation or university.

The application consists of four sections:

- | | |
|-------------|--|
| Section I | School District Information |
| Section II | Elementary Science Program Needs and Plans |
| Section III | Superintendent's Statement |
| Section IV | Leadership Team Information |

The original and two (2) copies of the completed application must be returned to the NSRC no later than March 31, 1992. Applications should be typed.

Districts will be notified by April 24, 1992 as to the status of their application.

For additional information, please contact:

Olive Covington, Director of Outreach
National Science Resources Center
Arts and Industries Building, Room 1201
Smithsonian Institution
Washington, DC 20560
(202) 357-2555

The 1992 Leadership Institutes will be held
June 22-26 and July 20-24.

Please check one of the following:

☐ Can only attend June 22-26

☐ Can only attend July 20-24

☐ Either date is acceptable

Chances for selection are greater if either date is acceptable.

SECTION I

School District Information

A. Demographics

1. Total number of students enrolled K-12: _____
2. Total number of elementary students: _____
3. Total number of elementary teachers: _____
4. Total number of schools:
_____ Elementary (Grades ____ through ____)
_____ Middle (Grades ____ through ____)

Racial/ethnic composition of the students in your district:

- _____ % American Indian or Native Alaskan
_____ % Asian or Pacific Islander
_____ % Hispanic
_____ % Black, not Hispanic origin
_____ % White, not Hispanic origin

B. Current Elementary Science Program

1. Indicate minutes per week typically devoted to science in your elementary schools:
Primary (grades K-3) _____ minutes per week
Intermediate (grades 4-6) _____ minutes per week
2. List title and source of science curriculum materials currently used in your school district at each grade level (K-6). Include title and publisher of textbook series, if applicable. Indicate whether textbooks are supplementary or basic to your program. Also give date of most recent adoption.

3. Briefly describe how your district currently does the following:

- Selects and/or develops elementary science curriculum materials
- Supplies elementary teachers with science apparatus and supplies
- Provides inservice education in science to elementary school teachers
- Assesses student learning in science
- Develops administrative and community support for new instructional programs

C. Alliances and Partnerships

List corporations, universities, or other community organizations that might be willing to help your district implement a hands-on elementary science program. (Please use back of page.)

SECTION II

Elementary Science Program Needs and Plans

A. List the elementary science program needs in your district.

B. Describe steps your district is taking to implement a hands-on elementary science program.

(Use back of page if necessary.)

SECTION III

Superintendent's Statement

☐ I am enthusiastic about our district's participation in the NSRC Elementary Science Leadership Institute. Our school district is committed to the implementation of a hands-on elementary science program. I will come to Washington as head of my school district's team to demonstrate that commitment.

☐ I am enthusiastic about our district's participation in the NSRC Elementary Science Leadership Institute. I am unable to attend. However, I have designated _____ as team leader to represent me. After the institute, I will meet with the team to initiate a plan of action.

Signature _____

SECTION IV

Leadership Team Information

Team Member 1

Administrator*

Name: _____

Title: _____

School Address: _____

City: _____ State: _____ ZIP: _____ Telephone: _____

Home Address: _____

City: _____ State: _____ ZIP: _____ Telephone: _____

Social Security Number: _____

A. Education and Experience

As outlined below, summarize your experience on a separate sheet of paper. **Do not exceed two (2) pages.** You may attach a professional resume instead. Do not include a cover or any extra materials. The application should be typed.

1. **Current assignment.** Include name and title of your immediate supervisor.
2. **Formal Education.** Institution, type of degree, major, minor, and dates degrees were granted.
3. **Certification.** Type(s) of certification held.
4. **Employment Experience.** Please include teaching and other assignments that will provide an accurate portrayal of your experience.
5. **Professional Activities.** Examples: 1) membership in professional organization 2) publications 3) research interests.
6. **Related Activities.** Examples: 1) outreach to the community 2) liaison with local/regional businesses 3) involvement with special youth programs

*Superintendent of schools, assistant superintendent for curriculum and instruction, or assistant superintendent for elementary education.

B. State how you will make use of the plan your team will develop at the institute.

C. Describe how your school district will benefit from your participation in the institute.

Signature _____

SECTION IV

Leadership Team Information

Team Member 2

Curriculum Specialist*

Name: _____

Title: _____

School Address: _____

City: _____ State: _____ ZIP: _____ Telephone: _____

Home Address: _____

City: _____ State: _____ ZIP: _____ Telephone: _____

Social Security Number: _____

A. Education and Experience

As outlined below, summarize your experience on a separate sheet of paper. **Do not exceed two (2) pages.** You may attach a professional resume instead. Do not include a cover or any extra materials. The application should be typed.

1. **Current assignment.** Include name and title of your immediate supervisor.
2. **Formal Education.** Institution, type of degree, major, minor, and dates degrees were granted.
3. **Certification.** Type(s) of certification held.
4. **Employment Experience.** Please include teaching and other assignments that will provide an accurate portrayal of your experience.
5. **Professional Activities.** Examples: 1) membership in professional organization 2) publications 3) research interests.
6. **Related Activities.** Examples: 1) outreach to the community 2) liaison with local/regional businesses 3) involvement with special youth programs.

*Science coordinator, director of curriculum and instruction, or director of elementary education.

B. State how you will make use of the plan your team will develop at the institute.

C. Describe how your school district will benefit from your participation in the institute.

Signature _____

SECTION IV

Leadership Team Information

Team Member 3

Elementary School Teacher

Name: _____

Title: _____

School Address: _____

City: _____ State: _____ ZIP: _____ Telephone: _____

Home Address: _____

City: _____ State: _____ ZIP: _____ Telephone: _____

Social Security Number: _____

A. Education and Experience

As outlined below, summarize your experience on a separate sheet of paper. Do not exceed two (2) pages. You may attach a professional resume instead. Do not include a cover or any extra materials. The application should be typed.

1. **Current assignment.** Include name and title of your immediate supervisor.
2. **Formal Education.** Institution, type of degree, major, minor, and dates degrees were granted.
3. **Certification.** Type(s) of certification held.
4. **Employment Experience.** Teaching and/or other assignments, dates, and any additional information that will provide an accurate portrayal of leadership experience.
5. **Professional Activities.** Examples: 1) membership in professional organization 2) publications 3) research interests.
6. **Related Activities.** Examples: 1) outreach to the community 2) liaison with local/regional businesses 3) involvement with special youth programs.

B. State how you will make use of the plan your team will develop at the institute.

C. Describe how your school district will benefit from your participation in the institute.

Signature _____

SECTION IV

Leadership Team Information

Team Member 4

Scientist*

Name: _____

Title: _____

Work Address: _____

City: _____ State: _____ ZIP: _____ Telephone: _____

Home Address: _____

City: _____ State: _____ ZIP: _____ Telephone: _____

Social Security Number: _____

A. Education and Experience

As outlined below, summarize your experience on a separate sheet of paper. **Do not exceed two (2) pages.** You may attach a professional resume instead. Do not include a cover or any extra materials. The application should be typed.

1. **Current assignment.** Include name and title of your immediate supervisor.
2. **Formal Education.** Institution, type of degree/s.
3. **Certification.** Type(s) of certification held.
4. **Employment Experience.** Please include any teaching experience and other information relevant to your interest in precollege science education.
5. **Professional Activities.** Examples: 1) membership in professional organizations 2) publications 3) research interests.
6. **Related Activities.** Examples: 1) outreach to the community 2) liaison with local/regional partnerships, alliances, businesses 3) involvement with special youth programs.

*Scientist from a local industrial corporation, university, or federal research facility

B. State how you will make use of the plan your team will develop at the institute.

C. Describe how your school district will benefit from your participation in the institute.

Signature _____

NSRC NEWS

NATIONAL SCIENCE RESOURCES CENTER

SMITHSONIAN INSTITUTION • NATIONAL ACADEMY OF SCIENCES

Date: June 8, 1992

Contacts: Kathleen Holmay 301-588-6168
John Barrat 202-357-2627
Craig Hicks 202-334-2138

MEDIA ADVISORY

**What: Elementary Science Leadership Institutes
of the National Science Resources Center**

When: June 22-26, 1992; July 20-24, 1992

**Where: The S. Dillon Ripley Center of the Smithsonian Institution,
Washington, DC**

Twenty-nine teams from school districts throughout the country are gathering in Washington, D.C. this summer to learn how to encourage and foster hands-on science teaching in their local school districts.

The teams of four to six persons are made up of teachers, science supervisors, school administrators, scientists, and business and industry persons. They represent school districts in 15 states that include more than 1,200 elementary schools, serving over 832,000 elementary students.

The teams will spend a week participating in a national science education improvement effort. In workshops, they will use some of the best hands-on elementary science curriculum materials available today and will learn about hands-on curriculum materials and teaching methods from leading science educators and scientists. They will also hear from national business and public policy leaders about how they can become more effective in working within their communities to improve elementary science education.

The goal of the NSRC Elementary Science Leadership Institutes is to facilitate the work of each team in initiating a comprehensive hands-on elementary school science program in its own school district.

Begun in 1989 with one summer institute, the program has now become an annual one. This is the first year that two Leadership Institutes are being offered.

###

NSRC|NEWS

NATIONAL SCIENCE RESOURCES CENTER

SMITHSONIAN INSTITUTION • NATIONAL ACADEMY OF SCIENCES

June 8, 1992

Media Contacts: Kathleen Holmay (301) 588-6168
John Barrat (202) 357-2627

MEDIA ADVISORY

What: Elementary Science Leadership Institutes
of the National Science Resources Center

When: June 22-26 and July 20-24

Where: S. Dillon Ripley Center of the Smithsonian Institution,
Washington, DC

Who: Local teams of teachers, science supervisors, school
administrators, and business and industry representatives
(list enclosed)

Selected teams representing 29 school districts throughout the country are gathering in Washington, D.C. this summer to learn how to encourage and foster hands-on science teaching in their local school districts.

The teams of four to six persons will spend a week participating in a series of activities that are part of a national science education improvement effort and they will learn about hands-on science curriculum materials and teaching methods from leading science educators and scientists. They will hear from national business and public policy leaders about how they can become more effective in working within their communities to improve elementary science education.

The goal of the NSRC Elementary Science Leadership Institutes is to facilitate the work of each team in initiating a comprehensive hands-on elementary school science program in its own school district.

Begun in 1989 with one summer institute, the program has now become an annual event. This is the first year that two Leadership Institutes are being offered.

###

**Elementary Science
Leadership Institute
June 22-26, 1992**



Program

■ **National Science Resources Center**
SMITHSONIAN INSTITUTION - NATIONAL ACADEMY OF SCIENCES

The **National Science Resources Center** is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, D.C.

***Sponsors of the 1992 NSRC Elementary
Science Leadership Institutes***

National Science Foundation

U.S. Department of Education

The Dow Chemical Company Foundation

Hewlett-Packard Company

Carolina Biological Supply Company

The W.K. Kellogg Foundation Endowment Fund of the
National Academy of Sciences and the Institute of Medicine

1992 NSRC Elementary Science Leadership Institute

Developing the scientific and technological literacy of all students is critical to our nation's future, and should begin in the primary grades. Children can come to know and understand science best through hands-on experiences which enable them to work and think like scientists. In this way, they can learn to observe, record, pose questions, design experiments, and solve problems, thereby developing critical thinking skills that will serve them throughout their lives.

To help develop the leadership required to plan and implement a district-wide, hands-on elementary science program, the NSRC conducts annual institutes for teams from school districts across the country.

The two 1992 Elementary Science Leadership Institutes will prepare 29 teams of administrators, curriculum specialists, teachers, and scientists to design and implement hands-on science programs for their school districts, serving more than 832,000 children.

Institute participants enhance their leadership skills by engaging in workshops and discussions on

- **Science curriculum units** appropriate for children in grades one through six;
- **In-service education programs** to prepare elementary school teachers to teach hands-on science;
- **Support systems** for supplying hands-on science materials and equipment to elementary school teachers;
- **Assessment methods** for evaluating student performance, consistent with the goals of a hands-on elementary science program;
- **Interdisciplinary approaches** for integrating science instruction with other areas of the elementary school curriculum; and
- **Strategies** for building administrative and community support for a hands-on elementary science program.

***NSRC Elementary Science Leadership Institute
Participating School Districts
June 22-26, 1992***

Cotati-Rohnert Park Unified School District, Cotati, California

Los Angeles Unified School District/University of Southern California,
Los Angeles, California

Pittsburg Unified School District, Pittsburg, California

Redwood City/Menlo Park School Districts,
San Mateo County, California

Denver Public Schools, Denver, Colorado

Fulton County School District, Atlanta, Georgia

Troup County School District, LaGrange, Georgia

East Baton Rouge Parish School District, Baton Rouge, Louisiana

Iberville/West Baton Rouge Parish School Districts, Port Allen, Louisiana

School District of the City of Saginaw, Saginaw, Michigan

North/Central Hunterdon Elementary Science Consortium, Readington,
New Jersey

Community School District 26, Bayside, New York

The Einstein Project, Inc., Green Bay, Wisconsin

Lambton County Partnership, Sarnia, Ontario, Canada

**NSRC
Elementary Science
Leadership Institute
June 22-26, 1992**

Program

Monday, June 22, 1992

Smithsonian Institution
S. Dillon Ripley Center

8:00 a.m. Registration

Lobby, Room 3111

8:30 a.m. Welcoming Remarks

Douglas Lapp
Executive Director
National Science Resources Center

**Overview of Program and Introduction of Staff
and Participants**

Olive Covington
Director of Outreach
National Science Resources Center

9:30 a.m. Why Science?...What Science?

Doug Lapp

10:15 a.m. Break

**10:30 a.m. The Identification of Science Curriculum Materials
Appropriate for Grades One through Six**

Joe Griffith

Director

Science and Technology for Children Project

National Science Resources Center

10:50 a.m. Hands-on Workshop

The Life Cycle of Butterflies (Grade 2)

Science and Technology for Children (STC) Project

Pat McGlashan

STC Research Associate

National Science Resources Center

12:30 p.m. Lunch

1:30 p.m. Planning an Effective Elementary Science Program

Sally Shuler

Deputy Director

National Science Resources Center

2:15 p.m. Break

2:30 p.m. Charge to Participants

Olive Covington

Director of Outreach

National Science Resources Center

2:45 p.m. Leadership Team Work Sessions with Resource Team

Resource Team:

Judi Backman

Math/Science Coordinator
Highline Public Schools
Seattle, Washington

Bill Smith

Science Resource Specialist
Mesa Public Schools
Mesa, Arizona

Charles Hardy

Assistant Superintendent,
Instruction and Curriculum
Highline Public Schools
Seattle, Washington

Susan Sprague

Director, Science/Social Science
Mesa Public Schools
Mesa, Arizona

Becky Smith

Science/Social Sciences
Curriculum Editor
Mesa Public Schools
Mesa, Arizona

Jan Tuomi

City Science Coordinator
Science and Health Education
Partnership
University of California at
San Francisco

4:00 p.m. Plenary Session

4:30 p.m. Adjournment

6:00 p.m. Opening Reception and Dinner

National Academy of Sciences
2101 Constitution Avenue, NW
(Use C Street entrance)

Speaker

Frank Popoff

President and Chief Executive Officer
The Dow Chemical Company
Midland, Michigan

Tuesday, June 23, 1992

Smithsonian Institution
S. Dillon Ripley Center

8:00 a.m. Resource Room (3035) available until 8:30 a.m.

Note: The Resource Room will be open during
breaks and Leadership Team Work Sessions.

8:30 a.m. Opening

Olive Covington
Director of Outreach
National Science Resources Center

**9:00 a.m. Teaching Hands-on Science: Asking the Right Question
at the Right Time**

Eleanor Duckworth
Assistant Professor of Education
Harvard Graduate School of Education
Cambridge, Massachusetts

10:15 a.m. Break

10:30 a.m. Concurrent Hands-on Workshops

Mystery Spill and Inside Story (Grades 5, 6)
Chemicals, Health, Environment, and Me (CHEM)

Mark Koker
CHEM Assistant Director
Lawrence Hall of Science
University of California at Berkeley

Subsystems and Variables (Grade 3)
Science Curriculum Improvement Study (SCIS 3)

William McGinnis
Vice President
Delta Education, Inc.
Hudson, New Hampshire

12:00 p.m. Lunch

1:15 p.m. Building Community Support for a Hands-on Science Program

Ramon Lopez
Scientist/Project Manager
Applied Physics Laboratory
The Johns Hopkins University
Laurel, Maryland

2:15 p.m. Integrating Science Instruction into the Elementary School Curriculum

Wendy Binder
STC Research Associate
National Science Resources Center

Debby Deal
STC Research Associate
National Science Resources Center

3:15 p.m. Break

3:30 p.m. Leadership Team Work Sessions with Resource Team

Note: Resource Room (3035) is available for
use during this time.

5:00 p.m. Adjournment

Wednesday, June 24, 1992

Smithsonian Institution
S. Dillon Ripley Center

8:00 a.m. Resource Room (3035) open

8:30 a.m. Opening

Betty Olivolo
Outreach Program Associate
National Science Resources Center

9:00 a.m. Elements of an Effective Teacher Education Program

Susan Sprague
Director, Science/Social Studies
Mesa Public Schools

Becky Smith
Science/Social Sciences Curriculum Editor
Mesa Public Schools

Bill Smith
Science Resource Specialist
Mesa Public Schools

10:30 a.m. Break

10:45 a.m. Concurrent Hands-on Workshops

Fingerprinting and Crime Lab Chemistry (Grade 4)
Great Explorations in Math and Science (GEMS)

Kimi Hosoume
GEMS Assistant Director
Lawrence Hall of Science
University of California at Berkeley

Variables (Grade 5)
Full Option Science System (FOSS)

Kathy Daiker
FOSS Curriculum Developer
Lawrence Hall of Science
University of California at Berkeley

12:15 p.m. Lunch (Room 3111)

**Providing Materials Support for Hands-on
Elementary Science Programs**

Speaker
Sally Shuler
Deputy Director
National Science Resources Center

1:15 p.m. Bus Leaves Mall for Fairfax County, Virginia

**1:45 p.m. Tour of the Fairfax County Public Schools
Instructional Materials Processing Center
Springfield, VA**

Barbara Carey
Coordinator
Instructional Materials Processing Center
Fairfax County Public Schools

3:30 p.m. **Discussion on Elements of an Effective Elementary Science
Materials Support System**

**Fairfax County Public Schools
Lacey Instructional Center
Annandale, VA**

Panel:

Jack Greene

Science Curriculum Coordinator
Fairfax County Public Schools

Susan Sprague

Director, Science/Social Studies
Mesa Public Schools

Leslie J. Benton

Former Coordinator
Instructional Materials Processing
Center
Fairfax County Public Schools

Judi Backman

Math/Science Coordinator
Highline Public Schools

Charles Hardy

Assistant Superintendent,
Instruction and Curriculum
Highline Public Schools

Jan Tuomi

City Science Coordinator
Science and Health Education
Partnership
University of California at
San Francisco

5:00 p.m. **Adjournment**

(Transportation to Normandy Inn)

Thursday, June 25, 1992

Smithsonian Institution
S. Dillon Ripley Center

8:00 a.m. Resource Room (3035) open

8:30 a.m. Opening

Sally Shuler
Deputy Director
National Science Resources Center

9:00 a.m. Leadership Team Work Sessions with Resource Team

12:15 p.m. Lunch

1:15 p.m. Concurrent Hands-on Workshops

Plant Growth and Development (Grade 3)
Science and Technology for Children Project

Pat McGlashan
STC Research Associate
National Science Resources Center

Magnets and Motors (Grade 6)
Science and Technology for Children Project

David Hartney
STC Research Associate
National Science Resources Center

2:45 p.m. Break

3:00 p.m. Assessing Student Learning in Science

Sabra Price

Senior Research Associate

Program Evaluation and Research Group

Lesley College Graduate School of Education

Cambridge, Massachusetts

5:00 p.m. Adjournment

6:30 p.m. Reception and Dinner

Smithsonian Institution Building (The Castle)

1000 Jefferson Drive, SW

Speaker

Michael H. Robinson

Director

National Zoological Park

Smithsonian Institution

Friday, June 26, 1992

Smithsonian Institution
S. Dillon Ripley Center

8:00 a.m. Resource Room (3035) open

8:30 a.m. Opening

Doug Lapp
Executive Director
National Science Resources Center

9:00 a.m. Hands-on Workshop

Myself and Others (Grade K-1)
Insights Curriculum

Carolee Matsumoto
Insights Curriculum Director
Educational Development Center
Newton, Massachusetts

10:30 a.m. Break

11:00 a.m. Funding Sources for Elementary Science Program Improvement

Allen Schmieder
Dwight D. Eisenhower National Mathematics and Science Program
U.S. Department of Education

Susan P. Snyder
Section Head
Networking and Teacher Preparation
Division of Teacher Preparation and Enhancement
National Science Foundation

12:15 p.m. Lunch

- 1:30 p.m. Charge to Team Leaders**
Olive Covington
Director of Outreach
National Science Resources Center
- 1:40 p.m. Review of Action Plans**
Small Group Discussions
- 3:00 p.m. Break**
- 3:15 p.m. Plenary Session**
Reports from Team Leaders
- 4:30 p.m. Closing Remarks**
Doug Lapp
Executive Director
National Science Resources Center
- 5:00 p.m. Adjournment**

**NSRC
Elementary Science
Leadership Institute
June 22-26, 1992**

Participants

***Cotati-Rohnert Park Unified
School District***

Cotati, California

Team Leader

Greta Viguie

Director of Curriculum

Team Members

Phyllis Weathers

Teacher

Monte Vista Elementary School

Sharon Janulaw

Teacher

Marguerite Hahn Elementary School

E. Blake Peterson

Regional Sales Engineer for Europe

Hewlett-Packard Company

***Los Angeles Unified School
District/University of
Southern California***

Los Angeles, California

Team Leader

Lois Slavkin

Executive Director

Center to Advance Precollege Science
Education

University of Southern California

Team Members

Donnalyn Jaque-Anton

District Director of Professional Development

Evangelina Stockwell

Assistant Superintendent

Los Angeles Unified School District 5

Victor H. Lamkay

Teacher Advisor

Los Angeles Unified School District 1

Roseyolanda White

Teacher

Leo Politi School

Los Angeles Unified School District 3

(Los Angeles, con't)

Neil Dixon

Teacher

Woodcrest Elementary School

Los Angeles Unified School District 7

Carol Takemoto

Science Education Coordinator

Center to Advance Precollege Science
Education

University of Southern California

Harold C. Slavkin

*Professor of Craniofacial Molecular
Biology*

School of Dentistry

University of Southern California

***Pittsburg Unified School
District***

Pittsburg, California

Team Leader

Wayne Miller

*District Director of Curriculum and
Instruction*

Team Members

Stefan Gair

Curriculum Coordinator

David A. Nickles

*Science/Math Curriculum Coordinator
for K-12*

Contra Costa County Office of Education

Darlynn Bolcerek

Teacher

Heights Elementary School

Michael Mann

Research Engineer

The Dow Chemical Company

Continental Operations

**Redwood City/Menlo Park
School Districts**

San Mateo County, California

Team Leader

Mary Lairon

Director of Curriculum and Instruction
Redwood City School District

Team Members

Jo Sauer Mitchell

*Assistant Superintendent for Curriculum
and Instruction*

Menlo Park City School District

Rita Orlandini

Science Resource Teacher
Redwood City School District

Nancy M. Rankin

Science Specialist

Oak Knoll School

Menlo Park City School District

Dorian Fondahl

Teacher

Garfield Elementary School
Redwood City School District

Jim Vanides

*Research and Development Project
Manager*

Scientific Instruments Division
Hewlett-Packard Company

Denver Public Schools

Denver, Colorado

Team Leader

Cheryl Betz

Assistant Superintendent
Curriculum and Instruction

Team Members

Robert Matchett

*Health, Science, and Environmental
Studies Supervisor, K-12*

Luis A. Lozano

Teacher

Carson Elementary School

Floyd A. Boyard

Manager, Analytical Services
Marathon Oil Company

Fulton County School District

Atlanta, Georgia

Team Leader

Dorothy R. Fielder

*Executive Director for Elementary
Curriculum*

Team Members

Judy H. Dennison

Elementary Science Coordinator

Gary Dean Hawsey

Instructional Resource Teacher
Barnwell Elementary School

Ronald Moore

Systems Engineer
Hewlett-Packard Company

Troup County School District

LaGrange, Georgia

Team Leader

Joyce C. Morgan
Assistant Superintendent

Team Members

Patricia B. Barton
Director of Elementary Curriculum

Margaret O'Gwynn Hurd
Teacher

Mountville Elementary School

John Carleton Hurd
Professor and Chairman of Biology
LaGrange College

**East Baton Rouge Parish
School District**

Baton Rouge, Louisiana

Team Leader

Mary Ellen Jordan
Assistant Superintendent
Instructional Services

Team Members

Margie M. Montgomery
Elementary Science Education Supervisor

Mignon Morgan
Elementary Science Specialist

Press L. Robinson
*Associate Vice Chancellor for Academic
Affairs*
Southern University

Emily Young
Education Coordinator
Louisiana State University

**Iberville/West Baton Rouge
Parish School Districts**

Port Allen, Louisiana

Team Leader

Ronald E. Egros
Coordinator of Curriculum and Instruction
Iberville Parish School District

Team Members

Greg Grimes
Supervisor of Instruction
West Baton Rouge Parish School District

Margaret H. Smith
Teacher

Cohn Elementary School
West Baton Rouge Parish School District

Hedwig Ohlmeyer Carville
Teacher

Iberville Elementary School
Iberville Parish School District

Sue Blanchard
Community Relations Coordinator
The Dow Chemical Company
Louisiana Division

**School District of the City of
Saginaw**

Saginaw, Michigan

Team Leader

William D. Cheaney

*Assistant Superintendent for Elementary
Education*

Team Members

Jo Ann Pelkki

Science Coordinator, K-12

Laura Terwilliger

Teacher

Chester Miller Elementary School

Michael J. Colucci

Senior Research Engineer

The Dow Chemical Company

Michigan Division

**North/Central Hunterdon
Elementary Science
Consortium**

Readington, New Jersey

Team Leader

Thomas W. Gannon

Superintendent

Readington Township Public Schools

Team Members

Robert Philip Bees

Science Supervisor

Readington Township Public Schools

Pamela B. Lester

Math/Science Enrichment Teacher

Patrick McGaheran Elementary School

Clinton Township School District

Jill Gambaccini

Public Affairs Associate

Merck & Company, Inc.

Cathleen Roberts

Staff Chemist

Merck Research Laboratories

Merck & Company, Inc.

Community School District 26
Bayside, New York

Team Leader

Anita E. Saunders
*District Director of Instruction and
Professional Development*

Team Members

Rita I. Ratner
*Education Administrator for Staff
Development*

Geraldine Wiener
Teacher
Public School 188

Eleanor Anne Miele
*Adjunct Assistant Professor of Science
Education*
Adelphi University

The Einstein Project, Inc.
Green Bay, Wisconsin

Team Leader

David Ewald
Superintendent of Schools
School District of Denmark

Team Members

A. Dean Hess
Science Department Chairperson
DePere High School
Unified School District of DePere

Diane McNeill
Teacher
Christa McAuliffe Elementary School
Green Bay School District

Catherine M. Londo
Assistant Principal
St. Joseph School
Green Bay School District

Jim Hertel
Vice President
Research and Development
Paper Converting Machine Company

David Turiff
President
The Einstein Project, Inc.

Lambton County Partnership

Samia, Ontario, Canada

Team Leader

Allan Cole

Curriculum Coordinator

Lambton County Board of Education

Team Members

Onorio Frezza

Program Coordinator

Lambton County Separate School Board

Ann Larsen

Junior Consultant

Lambton County Board of Education

Jane McLaughlin

Language Arts Consultant

Lambton County Separate School Board

Inderjit G. McManus

*Manager of Employee Development
and Recruiting*

Research and Development

Dow Chemical Canada, Inc.

Jack M. Pal

Educational Affairs Manager

Dow Chemical Canada, Inc.

Other Attendees

Steve Binkley
Coordinator of Elementary Science
Carolina Biological Supply Company
Burlington, North Carolina

Rosa M. Catalá
Science Coordinator
Colegio Madrid
México City, México

José Antonio Chamizo
Director
Colegio Madrid
México City, México

Socorro Chávez
Science Coordinator
Colegio de las Vizcainas
México City, México

Inés L. Cifuentes
Research Associate
Department of Terrestrial Magnetism
Carnegie Institution of Washington
Washington, D.C.

Winnie Convery
Project Assistant
Corporate Council for Mathematics and
Science Education
Coordinating Council for Education
National Research Council
Washington, D.C.

Greg Coverdale
Science Consultant
State Department of Education
Lansing, Michigan

Janice Earle
Program Director
Statewide Systemic Initiatives
National Science Foundation
Washington, D.C.

Richard Franks
Head
Genetics Department
Carolina Biological Supply Company
Burlington, North Carolina

Jack Hopper
Science Specialist
Florida State Department of Education
Tallahassee, Florida

Hadassah Lieberman
Consultant
Corporate Council for Mathematics and
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Jan Loveless
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Dow Chemical U.S.A.
Midland, Michigan

Celestine Pea
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Baton Rouge, Louisiana

Magdalena Rfús
Director
Colegio de las Vizcainas
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Nancy Thomas
Contributions Manager
Hewlett-Packard Company
Palo Alto, California

**NSRC
Elementary Science
Leadership Institute
June 22-26, 1992**

Presenters

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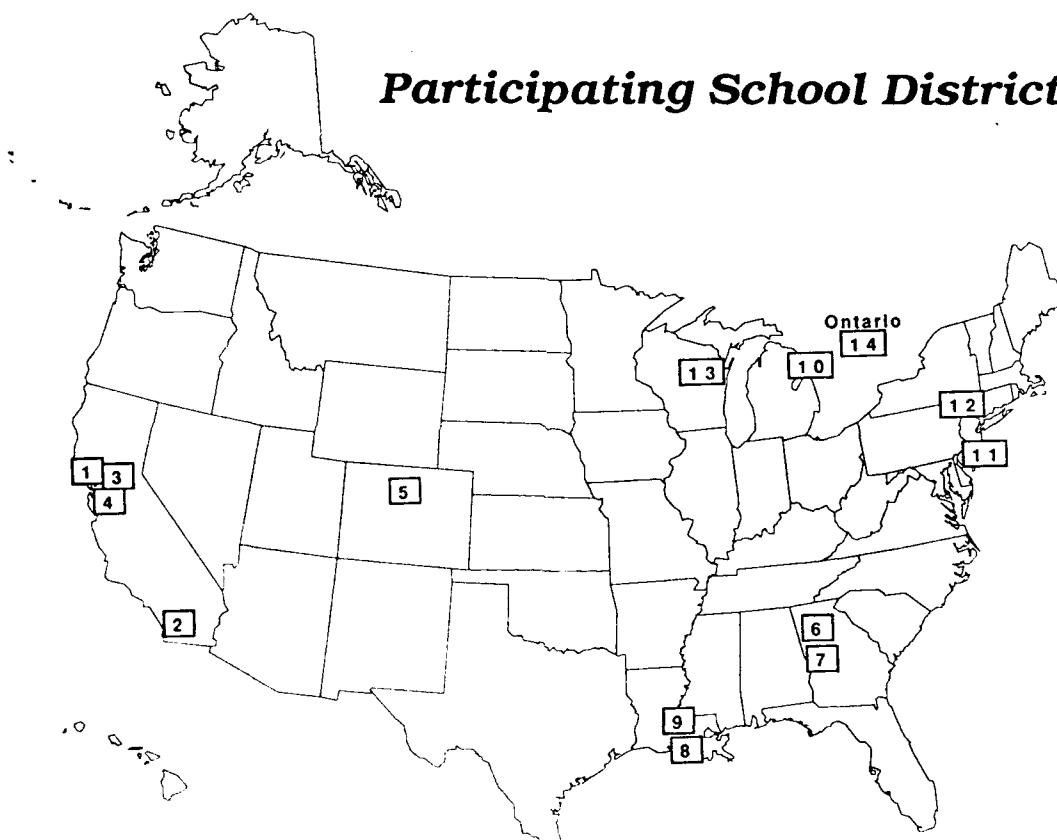
**NSRC
Elementary Science
Leadership Institute
June 22-26, 1992**

Participating School Districts

School District	Total Students	Elementary Students	Elementary Teachers	Elementary Schools
Cotati-Rohnert Park Unified School District, Cotati, CA	7,280	4,681	209	9
Los Angeles Unified School District/USC/ Los Angeles, CA	800,357	347,607	13,106	417
Pittsburg Unified School District, Pittsburg, CA	8,471	4,613	151	7
Redwood City/Menlo Park School Districts, San Mateo, CA	9,764	7,740	401	15
Denver Public Schools, Denver, CO	58,004	34,341	1,748	81
Fulton County School District, Atlanta, GA	45,206	22,750	888	32
Troup County School District, LaGrange, GA	5,318	2,603	155	5
East Baton Rouge Parish School District, Baton Rouge, LA	60,653	34,460	2,379	63
Iberville/West Baton Rouge Parish School Districts, Port Allen, LA	9,141	4,823	197	11
School District of the City of Saginaw, Saginaw, MI	14,352	9,189	411	24
North/Central Hunterdon Elementary Science Consortium, Readington, NJ	9,440	9,440	682	16
Community School District 26, Bayside, NY	14,181	8,980	5,201	20
The Einstein Project, Inc., Green Bay, WI	38,230	21,083	1,422	62
Lambton County Partnership, Sarnia, Ontario, Canada	24,361	16,140	1,022	59
Total	1,104,758	528,450	27,972	821

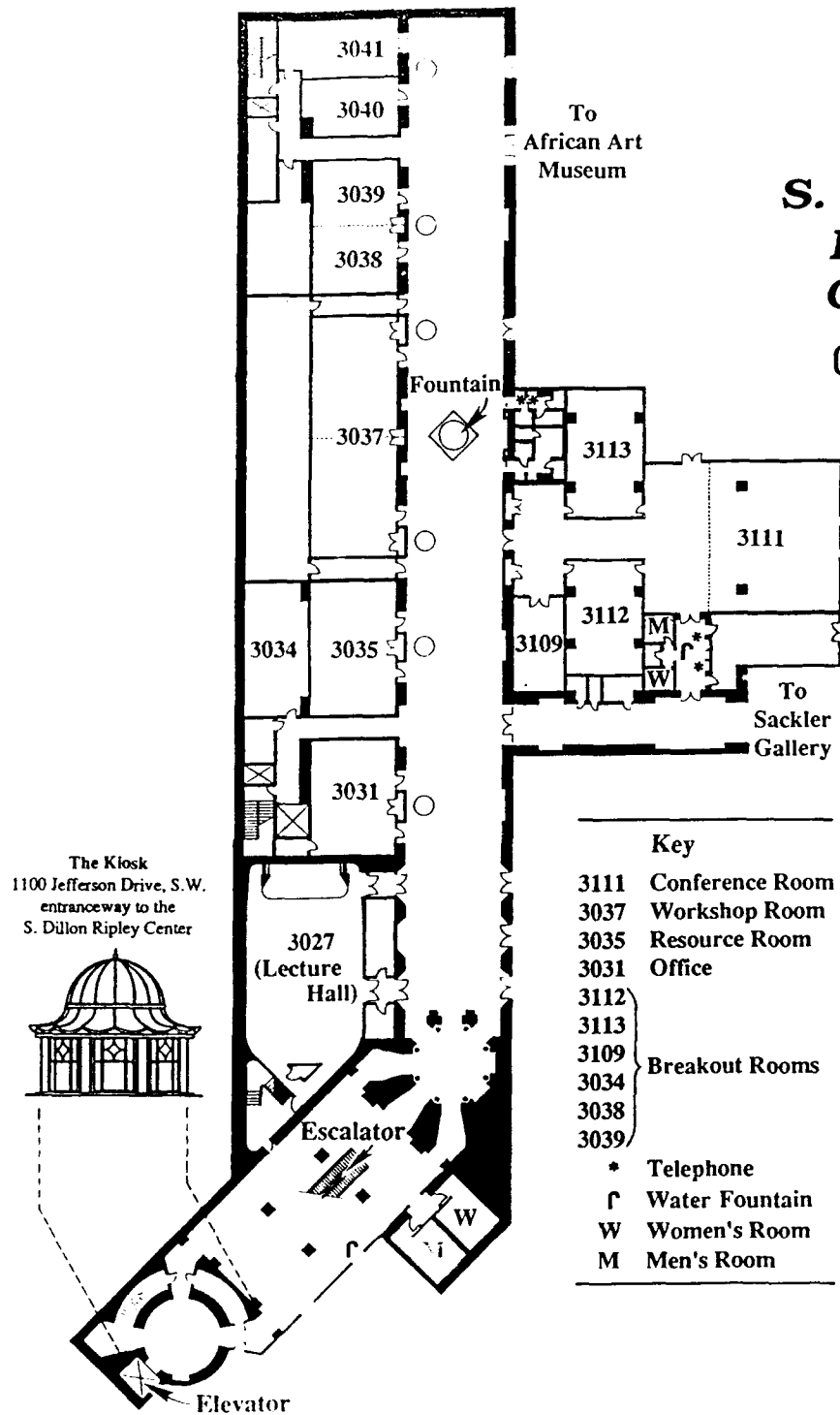
**NSRC
Elementary Science
Leadership Institute
June 22-26, 1992**

Participating School Districts



- | | |
|---|---|
| 1. Cotati-Rohnert Park Unified School District, Cotati, CA | 8. East Baton Rouge Parish School District, Baton Rouge, LA |
| 2. Los Angeles Unified School District/ USC/Los Angeles, CA | 9. Iberville/West Baton Rouge Parish School Districts, Port Allen, LA |
| 3. Pittsburg Unified School District, Pittsburg, CA | 10. School District of the City of Saginaw, Saginaw, MI |
| 4. Redwood City/Menlo Park School Districts, San Mateo, CA | 11. North/Central Hunterdon Elementary Science Consortium, Readington, NJ |
| 5. Denver Public Schools, Denver, CO | 12. Community School District 26, Bayside, NY |
| 6. Fulton County School District, Atlanta, GA | 13. The Einstein Project, Inc., Green Bay, WI |
| 7. Troup County School District, LaGrange, GA | 14. Lambton County Partnership, Sarnia, Ontario, Canada |

**S. Dillon
Ripley
Center**
(Level 3)



Program



NSRC Elementary Science Leadership Institute July 20-24, 1992

National Science Resources Center
SMITHSONIAN INSTITUTION - NATIONAL ACADEMY OF SCIENCES

Program

 **National Science Resources Center**
SMITHSONIAN INSTITUTION - NATIONAL ACADEMY OF SCIENCES

The **National Science Resources Center** is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, D.C.

***Sponsors of the 1992 NSRC Elementary
Science Leadership Institutes***

National Science Foundation

U.S. Department of Education

The Dow Chemical Company Foundation

Hewlett-Packard Company

Carolina Biological Supply Company

The W.K. Kellogg Foundation Endowment Fund of the
National Academy of Sciences and the Institute of Medicine

1992 NSRC Elementary Science Leadership Institute

Developing the scientific and technological literacy of all students is critical to our nation's future, and should begin in the primary grades. Children can come to know and understand science best through hands-on experiences which enable them to work and think like scientists. In this way, they can learn to observe, record, pose questions, design experiments, and solve problems, thereby developing critical thinking skills that will serve them throughout their lives.

To help develop the leadership required to plan and implement a district-wide, hands-on elementary science program, the NSRC conducts annual institutes for teams from school districts across the country.

The two 1992 Elementary Science Leadership Institutes will prepare 29 teams of administrators, curriculum specialists, teachers, and scientists to design and implement hands-on science programs for their school districts, serving more than 832,000 elementary school children.

Institute participants enhance their leadership skills by engaging in workshops and discussions on

- **Science curriculum units** appropriate for children in grades one through six;
- **In-service education programs** to prepare elementary school teachers to teach hands-on science;
- **Support systems** for supplying hands-on science materials and equipment to elementary school teachers;
- **Assessment methods** for evaluating student performance, consistent with the goals of a hands-on elementary science program;
- **Interdisciplinary approaches** for integrating science instruction with other areas of the elementary school curriculum; and
- **Strategies** for building administrative and community support for a hands-on elementary science program.

***NSRC Elementary Science Leadership Institute
Participating School Districts
July 20-24, 1992***

Cupertino Union School District, Cupertino, California

Dry Creek Joint Elementary School District, Roseville, California

Mt. Diablo Unified School District, Concord, California

Mountain View/Whisman School Districts, Mountain View, California

Ravenswood City School District, East Palo Alto, California

Torrance Unified School District, Torrance, California

Academy School District 20, Colorado Springs, Colorado

Dade County Public Schools, Miami, Florida

Shawnee Mission Public Schools, Shawnee Mission, Kansas

Lee County Schools, Tupelo, Mississippi

School District of University City, University City, Missouri

Erie 2-Chautauqua-Cattaraugus Board of Cooperative Education Services,
Angola, New York

Corvallis School District 509J, Corvallis, Oregon

Southern Brazoria County Coalition, Angleton, Texas

Hampton City Schools, Hampton, Virginia

**NSRC
Elementary Science
Leadership Institute
July 20-24, 1992**

Program

Monday, July 20, 1992

Smithsonian Institution
S. Dillon Ripley Center

8:00 a.m. Registration

Lobby, Room 3111

8:30 a.m. Welcoming Remarks

Douglas Lapp

Executive Director

National Science Resources Center

**Overview of Program and Introduction of
Participants and Staff**

Olive Covington

Director of Outreach

National Science Resources Center

9:30 a.m. Why Science?...What Science?

Doug Lapp

10:15 a.m. Break

10:30 a.m. Hands-on Workshop

The Life Cycle of Butterflies (Grade 2)
Science and Technology for Children (STC) Project

Pat McGlashan
STC Consultant
National Science Resources Center

12:00 p.m. Lunch

1:15 p.m. Planning an Effective Elementary Science Program

Sally Shuler
Deputy Director
National Science Resources Center

2:15 p.m. Charge to Participants

Olive Covington
Director of Outreach
National Science Resources Center

2:30 p.m. Break

2:45 p.m. Leadership Team Work Sessions with Resource Team

Resource Team:

Judi Backman
Math/Science Coordinator
Highline Public Schools
Seattle, Washington

Susan Sprague
Director, Science/Social Science
Mesa Public Schools
Mesa, Arizona

Charles Hardy
Assistant Superintendent,
Instruction and Curriculum
Highline Public Schools
Seattle, Washington

Jan Tuomi
City Science Coordinator
Science and Health Education
Partnership
University of California at
San Francisco

Becky Smith
Science/Social Sciences
Curriculum Editor
Mesa Public Schools
Mesa, Arizona

Emma Walton
Science Program Coordinator
Anchorage School District
Anchorage, Alaska

Bill Smith
Science Resource Specialist
Mesa Public Schools
Mesa, Arizona

4:00 p.m. Plenary Session

4:30 p.m. Adjournment

6:30 p.m. Opening Reception and Dinner

Smithsonian Institution Building (The Castle)
1000 Jefferson Drive, S.W.

Speaker

F. James Rutherford
Chief Education Officer and Director, Project 2061
American Association for the Advancement of Science

Tuesday, July 21, 1992

Smithsonian Institution
S. Dillon Ripley Center

8:00 a.m. Resource Room (3034) available until 8:30 a.m.

Note: The Resource Room will be open during
breaks and Leadership Team Work Sessions.

8:30 a.m. Opening

Olive Covington
Director of Outreach
National Science Resources Center

**8:45 a.m. Teaching Hands-on Science: Asking the Right Question
at the Right Time**

Jack Easley
Professor Emeritus of Teacher Education
University of Illinois
Champaign, Illinois

10:15 a.m. Break

10:30 a.m. Concurrent Hands-on Workshops

Mystery Spill and Inside Story (Grades 5, 6)
Chemicals, Health, Environment, and Me (CHEM)

Sheila Pirkle
Associate Director
Center for Science and Mathematics Literacy
Louisiana State University
Baton Rouge, Louisiana

Subsystems and Variables (Grade 3)
Science Curriculum Improvement Study (SCIS 3)

William McGinnis
Vice President
Delta Education, Inc.
Hudson, New Hampshire

12:00 p.m. Lunch

(Working lunch for scientists and engineers)

1:15 p.m. Assessing Student Learning in Science

Gail Baxter
Research Associate
Graduate School of Education
University of California at Santa Barbara

3:15 p.m. Break

3:30 p.m. Leadership Team Work Sessions with Resource Team

Note: Resource Room (3034) is available for
use during this time.

5:00 p.m. Adjournment

Wednesday, July 22, 1992

Smithsonian Institution
S. Dillon Ripley Center

8:00 a.m. Resource Room (3034) open

8:30 a.m. Opening

Betty Olivolo
Outreach Program Associate
National Science Resources Center

8:45 a.m. Elements of an Effective Teacher Education Program

Susan Sprague
Director, Science/Social Studies
Mesa Public Schools

Becky Smith
Science/Social Sciences Curriculum Editor
Mesa Public Schools

Bill Smith
Science Resource Specialist
Mesa Public Schools

10:30 a.m. Break

10:45 a.m. Concurrent Hands-on Workshops

Fingerprinting and Crime Lab Chemistry (Grade 4)
Great Explorations in Math and Science (GEMS)

Carolyn Willard
GEMS Curriculum and Staff Development Specialist
Lawrence Hall of Science
University of California at Berkeley

Variables (Grade 5)
Full Option Science System (FOSS)

Larry Malone
FOSS Coordinator
Lawrence Hall of Science
University of California at Berkeley

12:15 p.m. Lunch

**1:15 p.m. Providing Materials Support for Hands-on
Elementary Science Programs**

Sally Shuler
Deputy Director
National Science Resources Center

1:45 p.m. Bus Leaves Mall for Fairfax County, Virginia

**2:15 p.m. Tour of the Fairfax County Public Schools
Instructional Materials Processing Center
Springfield, Virginia**

Barbara Carey
Coordinator
Instructional Materials Processing Center
Fairfax County Public Schools

4:00 p.m. **Case Studies of Effective Elementary Science
Materials Support Centers**

Small Group Discussion

Case Study 1

Jack Greene

Science Curriculum Coordinator
Fairfax County Public Schools

Leslie J. Benton

Former Coordinator
Instructional Materials Processing
Center
Fairfax County Public Schools

Case Study 2

Charles Hardy

Assistant Superintendent,
Instruction and Curriculum
Highline Public Schools

Judi Backman

Math/Science Coordinator
Highline Public Schools

Case Study 3

Susan Sprague

Director, Science/Social Studies
Mesa Public Schools

Bill Smith

Science Resource Specialist
Mesa Public Schools

Becky Smith

Science/Social Sciences Curriculum
Editor
Mesa Public Schools

Case Study 4

Jan Tuomi

City Science Coordinator
Science and Health Education
Partnership
University of California at
San Francisco

Case Study 5

Emma Walton

Science Program Coordinator
Anchorage School District

5:00 p.m. **Adjournment**

Thursday, July 23, 1992

Smithsonian Institution
S. Dillon Ripley Center

8:00 a.m. Resource Room (3034) open

8:30 a.m. Opening

Sally Shuler
Deputy Director
National Science Resources Center

8:45 a.m. Leadership Team Work Sessions with Resource Team

Note: Resource Room (3034) is available
for use during this time.

12:15 p.m. Lunch

(Working lunch for scientists and engineers)

1:15 p.m. Concurrent Hands-on Workshops

Plant Growth and Development (Grade 3)
Science and Technology for Children Project

Pat McGlashan
STC Consultant
National Science Resources Center

Magnets and Motors (Grade 6)
Science and Technology for Children Project

David Hartney
STC Consultant
National Science Resources Center

2:45 p.m. Break

3:00 p.m. Integrating Science Instruction into the Elementary School Curriculum

Wendy Binder

STC Research Associate
National Science Resources Center

Debby Deal

STC Research Associate
National Science Resources Center

**4:00 p.m. Building Community and Administrative Support
for Hands-on Science Programs**

Case Study: Midland Public Schools/Dow Chemical Company

Sarah Lindsey

Science Coordinator/Director
Science Resource Center
Midland Public Schools
Midland, Michigan

Tara Martin

Education Programs Supervisor
The Dow Chemical Company
Michigan Division
Midland, Michigan

5:00 p.m. Adjournment

6:30 p.m. Reception and Dinner

National Academy of Sciences
2101 Constitution Avenue, N.W.
(Use C Street entrance)

Speaker

Thomas E. Lovejoy

Assistant Secretary for External Affairs
Smithsonian Institution
Washington, D.C.

Friday, July 24, 1992

Smithsonian Institution
S. Dillon Ripley Center

8:00 a.m. Resource Room (3034) open

8:30 a.m. Opening

Doug Lapp
Executive Director
National Science Resources Center

9:00 a.m. Hands-on Workshop

Myself and Others (Grade K-1)
Insights Curriculum

Karen Worth
Senior Associate
Education Development Center, Inc.
Newton, Massachusetts

10:30 a.m. Break

11:00 a.m. Funding Sources for Elementary Science Program Improvement

David Schindel
Program Director
Teacher Enhancement Program
National Science Foundation

Allen Schmieder
Dwight D. Eisenhower National Mathematics and Science Program
U.S. Department of Education

12:15 p.m. Lunch

- 1:30 p.m. Charge to Team Leaders**
Olive Covington
Director of Outreach
National Science Resources Center
- 1:40 p.m. Review of Action Plans**
Small Group Discussions
- 3:00 p.m. Break**
- 3:15 p.m. Plenary Session**
Reports from Team Leaders
- 4:30 p.m. Closing Remarks**
Doug Lapp
Executive Director
National Science Resources Center
- 5:00 p.m. Adjournment**

**NSRC
Elementary Science
Leadership Institute
July 20-24, 1992**

Participants

***Cupertino Union
School District***
Cupertino, California

Team Leader
Harvey Barnett
Director, Technology Support

Team Members
Marybarbara Zorio
Science Resource Teacher
Fremont Older Elementary School

Pam Pell
Teacher
John Muir Elementary School

Mark Butler
Research and Development Section Manager
Hewlett-Packard Company

***Dry Creek Joint Elementary
School District***
Roseville, California

Team Leader
Robert F. Gomez
Assistant Superintendent
Eureka Union School District

Team Members
Jo Ann G. Hammer
*Assistant Superintendent for Instruction/
Curriculum Director*
Roseville City School District

Kathy Albrecht
Teacher
Heritage Oak School
Dry Creek School District

Robert J. Wharton
Hardware Design Engineer
Hewlett-Packard Company

**Mt. Diablo Unified School
District**

Concord, California

Team Leader

Jo Fyfe

Director, Instructional Services

Team Members

Kathleen P. Cline

Curriculum Specialist

Carole Macaluso

Teacher

Valle Verde Elementary School

Danae Vanderhoof

Senior Project Engineering Specialist

Continental Operations

The Dow Chemical Company

**Mountain View/Whisman
School Districts**

Mountain View, California

Team Leader

Susan K. Fettchenhauer

*Assistant Superintendent for Instruction
and Student Services*

Whisman School District

Team Members

Geri L. Martin

Teacher

Crittenden Middle School

Whisman School District

Susan Lee Mitchell

Teacher

Graham Middle School

Mountain View School District

Marjorie K. Lessey

Learning Products Developer

Hewlett-Packard Company

Ravenswood City School District

East Palo Alto, California

Team Leader

Stephen J. Waterman

*Assistant Superintendent of Instructional
Services*

Team Members

Paulette Johnson

Director of Curriculum

Leslie Mannos

Teacher

James B. Flood Magnet School

Jacques Leibovitz

Scientist

Hewlett-Packard Company

Torrance Unified School District

Torrance, California

Team Leader

Arnold C. Plank

Assistant Superintendent, Educational Services

Team Members

Nancy Raiche

Curriculum Coordinator

Kay M. Griffith

Teacher

Walteria Elementary School

Steven Whitehead

Community Relations Coordinator

Los Angeles Operations

The Dow Chemical Company

Academy School District 20
Colorado Springs, Colorado

Team Leader

H. Mack Clark
Assistant Superintendent

Team Members

Lew Davis
Principal
Woodmen-Roberts Elementary School

Barbara S. Betzler
Teacher
Mountain View Elementary School

Justin Morrill, Jr.
Research and Development Section Manager
Colorado Telecommunications Division
Hewlett-Packard Company

Dade County Public Schools
Miami, Florida

Team Leader

Diana Urbizu
Director for Instruction
Bureau of Instructional Support and
Curriculum Development

Team Members

Constance Thornton
District Instructional Coordinator for Science

Ted Boydston
District Instructional Coordinator for Science

Janice Hopton
Principal
Bunche Park Elementary School

Beverly Feuer Gross
Teacher
Oak Grove Elementary School

Carlos Gonzalez
Vice President, Research and Development
The Dow Chemical Company
Latin America

Shawnee Mission Public Schools

Shawnee Mission, Kansas

Team Leader

Jo-Anne Grote

*Associate Superintendent for Elementary
Schools*

Team Members

Gene R. Johnson

Director of Elementary Programs

Lynn Hanrahan

Elementary Science Resource Specialist

Mary M. Sapp

Curator of Education

Kansas City Museum

Kansas City, Missouri

Lee County Schools

Tupelo, Mississippi

Team Leader

Cecil S. Weeks

Superintendent

Team Members

Amelia Anglin

Elementary Curriculum Coordinator

Charlotte Leake

Teacher

Verona Junior High School

Joe F. Thompson

Director

National Science Foundation Engineering

Research Center for Computational

Field Simulation

Mississippi State University

**School District of
University City**
University City, Missouri

Team Leader

Gloria J. Davis
Assistant Superintendent

Team Members

Clara T. McCrary
Elementary Science Coordinator

Darlene M. Norfleet
Teacher
Slynn Park Elementary School

P. Scott Glaspie
Manager
External Research & Development Funding
and Management Information Systems
Monsanto Company

**Erie 2-Chautauqua-Cattaraugus
Board of Cooperative Education
Services (BOCES)**
Angola, New York

Team Leader

Garry W. Dole
Science Resources Coordinator
Erie 2-Chautauqua-Cattaraugus BOCES

Team Members

Terrance L. Radecki
Principal
Lincoln Elementary School
Jamestown Public Schools

Sally Ernwein
Teacher
Mayville Central School
Mayville Central School District

Bonnie Jeffe
Teacher
Eaden Elementary School
Eaden Central School District

Philip R. Magnuson
Teacher
Panama Central School
Panama Central School District

Edward C. Kisailus
Associate Professor, Biology
Canisius College

Corvallis School District 509J

Corvallis, Oregon

Team Leader

Mary M. Johnson
Curriculum Coordinator (K-8)

Team Members

Linda McJunkin
Science Curriculum Specialist (K-12)

Karen Eason
Teacher
Lincoln Elementary School

Gerhard B. Behrens
Teacher
Inavale Elementary School

Colleen Llewellyn
Manufacturing Development Engineer
Hewlett-Packard Company

**Southern Brazoria County
Coalition**

Angleton, Texas

Team Leader

Mary Nell Boyd
Director of Elementary Education
Angleton Independent School District

Team Members

Eric Grimmatt
Principal
Brazoria Intermediate School
Columbia-Brazoria Independent
School District

Miriam Jordan
Teacher
Danbury Elementary School
Danbury Independent School District

Dianne Weiss
Teacher
Sweeny Elementary School
Sweeny Independent School District

Julian E. Suazo
Development Manager
Texas Division
The Dow Chemical Company

Hampton City Schools

Hampton, Virginia

Team Leader

Mary Frances Briley

Coordinator of Staff Development

Team Members

Joyce A. R. Weeks

Math/Science Curriculum Leader

Susan B. McBurney

Science Teacher Specialist

Spratley Middle School

Arthur W. Bowman

Associate Professor of Biology

Department of Biological Sciences

Hampton University

Other Attendees

Dennis Coutu
Science Resource Specialist
West Bay Collaborative
Coventry, Rhode Island

Claudia Dissel
Director
Corporate Council for Mathematics and
Science Education
Coordinating Council for Education
National Research Council
Washington, D. C.

Richard Franks
Head
Genetics Department
Carolina Biological Supply Company
Burlington, North Carolina

David T. Garza
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Minority Mathematics and Science Education
Cooperative (MMSEC)
Texas Higher Education Coordinating Board
Austin, Texas

Thomas Kowalczyk
Chief Engineer
Naval Undersea Warfare Center
Newport, Rhode Island

Clarence McMaster
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Education Relations Manager
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Michael White
Coordinator, Medical Education
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Merck, Sharpe and Dohme
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**NSRC
Elementary Science
Leadership Institute
July 20-24, 1992**

Presenters

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**NSRC
Elementary Science
Leadership Institute
July 20-24, 1992**

NSRC Staff

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Sally Shuler, Deputy Director
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Diane Mann, Administrative Associate
Gail Greenberg, Executive Administrative
Assistant
Charmane Beverly, Administrative Assistant
Mary Garino, Office Aide

Outreach and Information Dissemination

Olive Covington, Outreach Director
Betty Olivolo, Program Officer
Catherine Harris, Program Assistant
Cathy Sparks, Project Assistant
Lisa Faden, Office Aide
Susan Cohen, Evaluation Consultant
Debbie Jones, Teacher Consultant
Ramon Lopez, Communications and
Networking Consultant

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Lynn Miller, Writer/Editor
Marilyn Fenichel, Writer/Editor
Catherine Corder, Publications Technology
Specialist
Max-Karl Winkler, Illustrator
Heidi Kupke, Publications Assistant

**Science and Technology for Children
Project (STC)**

Wendy Binder, STC Research Associate
Debby Deal, STC Research Associate
David Hartney, STC Consultant
Patricia McGlashan, STC Consultant
Katherine Stiles, STC Research Associate
Laura Pierce, Program Assistant

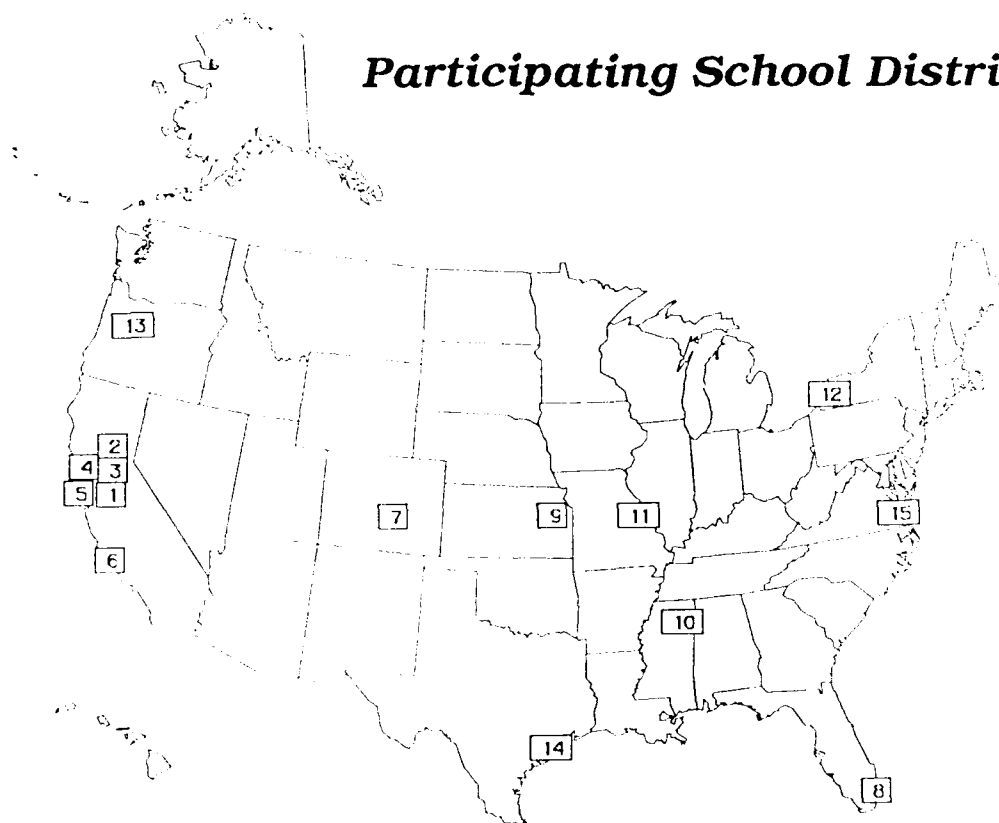
**NSRC
Elementary Science
Leadership Institute
July 20-24, 1992**

Participating School Districts

School District	Total Students	Elementary Students	Elementary Teachers	Elementary Schools
Cupertino Union School District, Cupertino, CA	12,808	9,927	324	18
Dry Creek Joint Elementary School District, Roseville, CA	12,821	8,623	300	11
Mt. Diablo Unified School District, Concord, CA	33,238	17,013	605	27
Mountain View/Whisman School Districts, Mountain View, CA	4,730	3,476	150	7
Ravenswood City School District, East Palo Alto, CA	4,200	4,200	180	6
Torrance Unified School District, Torrance, CA	20,528	10,636	355	17
Academy School District 20, Colorado Springs, CO	11,722	5,561	261	11
Dade County Public Schools, Miami, FL	304,287	165,487	7,450	188
Shawnee Mission Public Schools, Shawnee Mission, KS	30,714	17,583	742	43
Lee County Schools, Tupelo, MS	5,305	3,072	158	4
School District of University City, University City, MO	5,023	2,506	162	7
Erie 2 Chautauqua Cattaraugus BOCES, Angola, NY	44,898	33,481	1,988	73
Corvallis School District 500J, Corvallis, OR	7,417	4,236	175	10
Southern Brazoria County Coalition, Angleton, TX	12,856	6,152	377	10
Hampton City Schools, Hampton, VA	23,317	11,918	503	24
Total	533,864	303,871	13,730	456

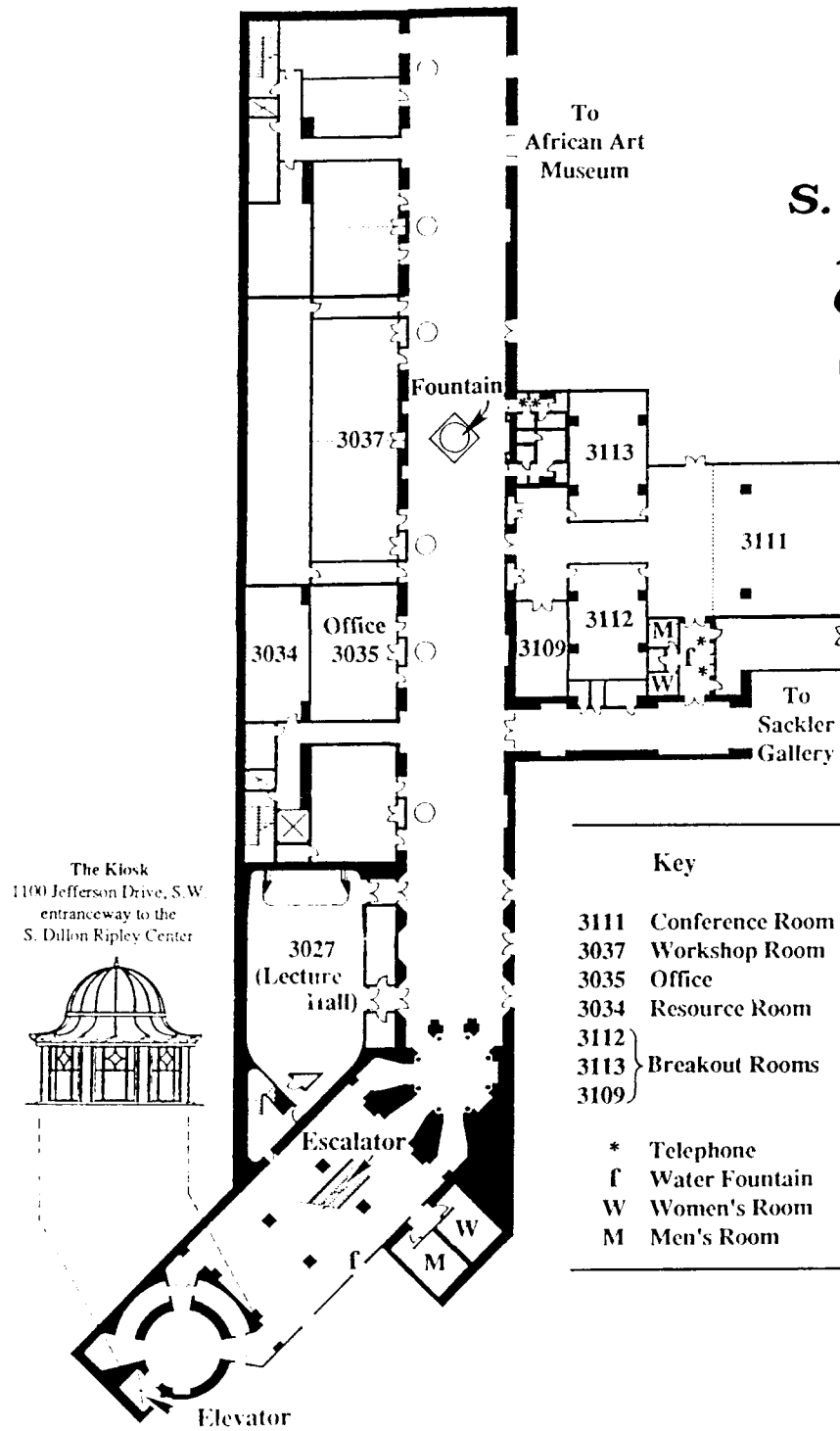
**NSRC
Elementary Science
Leadership Institute
June 22-26, 1992**

Participating School Districts



- | | |
|--|---|
| 1. Cupertino Union School District, Cupertino, CA | 9. Shawnee Mission Public Schools, Shawnee Mission, KS |
| 2. Dry Creek Joint Elementary School District, Roseville, CA | 10. Lee County Schools, Tupelo, MS |
| 3. Mt. Diablo Unified School District, Concord, CA | 11. School District of University City, University City, MO |
| 4. Mountain View/Whisman School Districts, Mountain View, CA | 12. Erie 2-Chataqua-Cattaraugus BOCES, Angola, NY |
| 5. Ravenswood City School District, East Palo Alto, CA | 13. Corvallis School District 509J, Corvallis, OR |
| 6. Torrance Unified School District, Torrance, CA | 14. Southern Brazoria County Coalition, Angleton, TX |
| 7. Academy School District 20, Colorado Springs, CO | 15. Hampton City Schools, Hampton, VA |
| 8. Dade County Public Schools, Miami, FL | |

**S. Dillon
Ripley
Center**
(Level 3)



Key

- 3111 Conference Room
- 3037 Workshop Room
- 3035 Office
- 3034 Resource Room
- 3112 } Breakout Rooms
- 3113 }
- 3109 }

- * Telephone
- f Water Fountain
- W Women's Room
- M Men's Room

Science for Children Program



NSRC Elementary School Science
Leadership Institute
July 8–12, 1991

SCIENCE FOR CHILDREN
Elementary Science Leadership Institute

Program

NATIONAL SCIENCE RESOURCES CENTER
Smithsonian Institution—National Academy of Sciences

The **National Science Resources Center** is sponsored by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science and mathematics in the nation's schools. Located in the Smithsonian Institution Arts and Industries Building in Washington, DC, the NSRC maintains a collection and database of science teaching resources, develops and disseminates curriculum materials for teachers, and sponsors outreach and leadership development activities to help school districts improve their science programs.

Sponsor of the 1991 Elementary Science Leadership Institute

Digital Equipment Corporation

Sponsors of NSRC Programs

Amoco Foundation, Inc.

Digital Equipment Corporation

The Dow Chemical Company Foundation

E. I. du Pont de Nemours and Company

Hewlett-Packard Foundation

John D. and Catherine T. MacArthur Foundation

U.S. Department of Defense

U.S. Department of Education

The W. K. Kellogg Foundation Endowment Fund
of the National Academy of Sciences and the Institute of Medicine

1991 NSRC Elementary Science Leadership Institute

Development of the scientific and technological literacy of all students is critical to the nation's future, and it should begin in the primary grades. In the primary grades, children come to know and understand science best through hands-on experiences, which enable them to work and think like scientists. Through these experiences, children learn to observe, record, pose questions, design experiments, and solve problems, developing critical thinking skills that will serve them throughout their lives.

Planning and implementation of a district-wide hands-on elementary science program requires informed leadership. To help develop this leadership, the NSRC conducts annual institutes for teams from school districts across the country. The 1991 Elementary Science Leadership Institute will prepare 16 teams of administrators, curriculum specialists, teachers, and scientists to design and implement hands-on science programs for their school districts.

Participants will engage in workshops and discussions on:

- **SCIENCE CURRICULUM UNITS** appropriate for grades one through six
- **SUPPORT SYSTEMS** for supplying hands-on science materials and apparatus to elementary school teachers
- **TEACHER EDUCATION PROGRAMS** to prepare elementary teachers to teach hands-on science
- **INTERDISCIPLINARY APPROACHES** for integrating science instruction with other curricula
- **ASSESSMENT METHODS** for evaluating student performance that are consistent with the goals of a hands-on elementary science program
- **PUBLIC RELATIONS STRATEGIES** for building administrative and community support for a hands-on elementary science program

Participating School Districts

Huntsville City School System, Huntsville, Alabama

Antioch Unified School District, Antioch, California

Fresno Unified School District, Fresno, California

Lynwood Unified School District, Lynwood, California

Idaho School District 25, Pocatello, Idaho

Elkhart Community Schools, Elkhart, Indiana

Iowa City Community School District, Iowa City, Iowa

Montgomery County Public Schools, Rockville, Maryland

Cambridge Public Schools, Cambridge, Massachusetts

Traverse City Area Public Schools, Traverse City, Michigan

Schools of the Archdiocese of St. Louis, St. Louis, Missouri

Santa Rosa Consolidated Schools 8, Santa Rosa, New Mexico

Community School District 16, Brooklyn, New York

Buffalo Public Schools, Buffalo, New York

Turtle Mountain Schools, Belcourt, North Dakota

Brazosport Independent School District, Freeport, Texas

SCIENCE FOR CHILDREN
NSRC Elementary Science Leadership Institute
July 8–12, 1991

Monday, July 8, 1991

Smithsonian Institution
S. Dillon Ripley Center
Rooms 3111/3037/3113

8:00 a.m. Registration

8:30 a.m. Welcoming Remarks

Douglas Lapp
Executive Director
National Science Resources Center

**Overview of Program and Introduction of Staff
and Participants**

Olive Covington
Director of Outreach
National Science Resources Center

9:30 a.m. Why Science?...What Science?

Doug Lapp

10:15 a.m. Break

**10:30 a.m. The Identification of Science Curriculum Materials
Appropriate for Grades One through Six**

Joe Griffith
Director, Science and Technology for Children Project
National Science Resources Center

10:50 a.m.	Hands-On Workshop <i>The Life Cycle of Butterflies</i> (Grade 2) Science and Technology for Children (STC) Project Pat McGlashan Research Associate, STC Project National Science Resources Center
12:30 p.m.	Lunch
1:30 p.m.	Designing an Effective Elementary Science Program Sally Shuler Deputy Director National Science Resources Center
2:15 p.m.	Charge to Participants Olive Covington Director of Outreach National Science Resources Center
2:30 p.m.	Break
3:00 p.m.	Team Meetings Task: Identification of Elementary Science Program Goals
4:00 p.m.	Plenary Session
4:30 p.m.	Adjournment
6:30 p.m.	Opening Reception and Dinner National Academy of Sciences 2101 Constitution Avenue, NW (Use C Street entrance)

Speakers

Samuel Fuller
 Vice President, Corporate Research
 Digital Equipment Corporation

 Maxine Singer
 President
 The Carnegie Institution of Washington

Tuesday, July 9, 1991

Smithsonian Institution
S. Dillon Ripley Center
Rooms 3111/3037/3113

- | | |
|------------|---|
| 8:30 a.m. | Opening

Olive Covington
Director of Outreach
National Science Resources Center |
| 9:00 a.m. | Teaching Hands-on Science: Asking the Right Question at the Right Time

Hubert Dyasi
Director, City College Workshop Center
The City College of New York

Karen Worth
Principal Investigator, Insights Project
Education Development Center
Newton, Massachusetts |
| 10:30 a.m. | Break |
| 10:45 a.m. | Hands-On Workshop
<i>Myself and Others</i> (Grade 1)
Insights Project

Karen Worth |
| 12:15 p.m. | Lunch |
| 1:15 p.m. | Building Administrative and Community Support for a Hands-on Elementary Science Program

Manert Kennedy
Executive Director
Colorado Alliance for Science |

2:15 p.m.	Team Work Sessions
4:15 p.m.	Break
4:30 p.m.	Plenary Session
5:00 p.m.	Adjournment

Wednesday, July 10, 1991

Smithsonian Institution
S. Dillon Ripley Center
Rooms 3111/3037/3113

- | | |
|-------------------|--|
| 8:30 a.m. | Opening
Doug Lapp
Executive Director
National Science Resources Center |
| 9:00 a.m. | Elements of an Effective Teacher Education Program
Karen Worth
Principal Investigator, Insights Project
Education Development Center

Susan Sprague
Director, Science/Social Sciences
Mesa Public Schools
Mesa, Arizona |
| 10:30 a.m. | Break |
| 10:45 a.m. | Concurrent Hands-On Workshops
<i>Plant Growth and Development (Grade 3)</i>
Science and Technology for Children Project
Pat McGlashan
Research Associate, STC Project
National Science Resources Center

<i>Magnets and Motors (Grade 6)</i>
Science and Technology for Children Project
David Hartney
Research Associate, STC Project
National Science Resources Center |
| 12:15 p.m. | Bus Leaves Mall for Fairfax County, Virginia
(Lunch en route) |

1:00 p.m.

Elements of an Effective Materials Support System

- **Introduction**

Bill Smith
Science Resource Specialist
Mesa Public Schools
Mesa, Arizona

Sally Shuler
Deputy Director
National Science Resources Center

- **Tour of the Fairfax County Public Schools
Science Materials Center**

Barbara Carey
Materials Specialist
Instructional Materials Processing Center
Fairfax County Public Schools

- **Discussion**

Jack Greene
Science Curriculum Coordinator
Fairfax County Public Schools

Leslie J. Benton
Coordinator
Instructional Materials Processing Center
Fairfax County Public Schools

Chuck Hardy
Assistant Superintendent, Instruction and Curriculum
Highline Public Schools
Seattle, Washington

Susan Sprague
Director, Science/Social Sciences
Mesa Public Schools
Mesa, Arizona

Judi Backman
Math/Science Coordinator
Highline Public Schools
Seattle, Washington

5:00 p.m.

Adjournment
(Transportation to Normandy Inn)

Thursday, July 11, 1991

Smithsonian Institution
S. Dillon Ripley Center
Rooms 3111/3037/3113

- | | |
|------------|--|
| 8:30 a.m. | Opening
Olive Covington
Director of Outreach
National Science Resources Center |
| 9:00 a.m. | Team Work Sessions |
| 12:15 p.m. | Lunch |
| 1:15 p.m. | Hands-On Workshop
<i>Fingerprinting and Crime Lab Chemistry</i> (Grade 4)
Great Explorations in Math and Science (GEMS)
Laura Lowell
GEMS Staff Specialist
Lawrence Hall of Science
University of California at Berkeley |
| 2:45 p.m. | Break |
| 3:00 p.m. | Assessment Methods for Evaluating Student Learning
Doug Reynolds
Chief, Bureau of Science Education
New York State Department of Education
Sabra Price
Senior Research Associate
Program Evaluation and Research Group
Lesley College Graduate School of Education
Cambridge, Massachusetts |

4:30 p.m. Plenary Session

5:00 p.m. Adjournment

6:30 p.m. Reception and Dinner

Smithsonian Institution Building (The Castle)
1000 Jefferson Drive, SW

Speaker

Shirley McBay
President
Quality Education for Minorities (QEM) Network
Washington, DC

Friday, July 12, 1991

Smithsonian Institution
S. Dillon Ripley Center
Rooms 3111/3037/3113

8:30 a.m.	Opening Sally Shuler Deputy Director National Science Resources Center
9:00 a.m.	Hands-On Workshop <i>Variables (Grade 5)</i> Full Option Science System (FOSS) Larry Malone Linda DeLucchi FOSS Coordinators Lawrence Hall of Science University of California at Berkeley
10:30 a.m.	Break
10:45 a.m.	Funding Sources for Elementary Science Program Improvement Susan P. Snyder Program Director Division of Teacher Preparation and Enhancement Directorate for Science and Engineering Education National Science Foundation
12:00 noon	Lunch
1:00 p.m.	Public Relations Strategies for Building Community Support for a Hands-on Elementary Science Program Kathleen Holmay Public Relations Consultant National Science Resources Center

1:30 p.m.	Charge to Team Leaders Olive Covington Director of Outreach National Science Resources Center
1:40 p.m.	Review of Action Plans Small Group Discussions
3:00 p.m.	Break
3:15 p.m.	Plenary Session Reports from Team Leaders
4:20 p.m.	Final Evaluation
4:30 p.m.	Closing Remarks Doug Lapp Executive Director National Science Resources Center
5:00 p.m.	Adjournment

NSRC Elementary Science Leadership Institute

July 8–12, 1991

Participants

Huntsville City School System Huntsville, Alabama

Team Leader

Ann Roy Moore
Manager
Elementary Education
Department of Instruction

Team Members

Judy Kirk
Science Area Specialist
J. Arlene Childers
Education Coordinator
Huntsville Alliance for Science
Project (HASP)
University of Alabama
Tereasa Rollings
Science Coordinator
Madison County Schools
John C. Wright
University Professor of Chemistry
Institute for Science Education
University of Alabama at Huntsville

Antioch Unified School District Antioch, California

Team Leader

Jim Patton
Director Research and Development

Team Members

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Curriculum and Assessment, K-12
Education
Susan Dragon
Teacher
Mission Elementary School
Colin R. Jones
Process Engineer
The Dow Chemical Company

Fresno Unified School District
Fresno, California

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Bullard Pyramid

Team Members

Richard Firpo
Area Superintendent
Edison Pyramid

Gloria Watts
Area Superintendent
Roosevelt Pyramid

Oliver M. Palacio
Area Superintendent
Fresno High Pyramid

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Teacher
Wolters Elementary School

Catherine Maxey
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The Dow Chemical Company
Midland, Michigan

Cathleen Loving
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Lynwood Unified School District
Lynwood, California

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Coordinator of Curriculum and Instruction

Team Members

Audrey M. Clark
Superintendent of Schools

Teresa Varnado
Resource Teacher
Wilson Elementary School

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Developmental Neurobiologist
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Team Members

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Elkhart, Indiana

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Teacher
Mary Feeser Elementary School

Charles Beeson
Science Department Chairman K-12

Patsy Bochlör
Associate Research Scientist
Consumer Healthcare Division
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Iowa City Community School District
Iowa City, Iowa

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Al Azinger
Associate Superintendent

Team Members

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Parent and Science Advisory
Committee Member
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Team Members

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Team Members

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Stupp Teacher Resource Center
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Team Members

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CLEARPOOL

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Mary Jean Syrek
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School 59 Science Magnet
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Team Members

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Yvonne Marie St. Claire
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NSRC Elementary Science Leadership Institute

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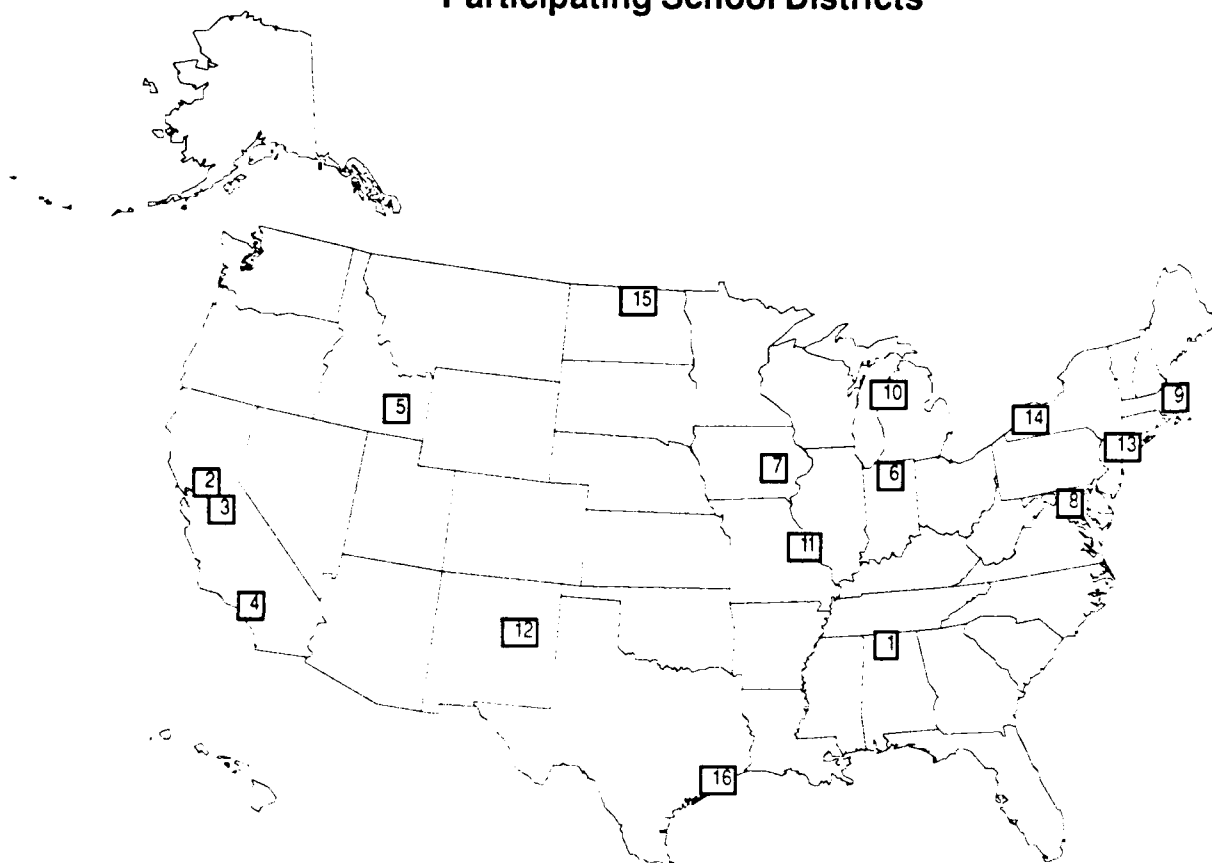
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1991 Elementary Science Leadership Institute

Participating School Districts



- | | |
|--|--|
| 1. Huntsville City School System, Huntsville, Alabama | 9. Cambridge Public Schools, Cambridge, Massachusetts |
| 2. Antioch Unified School District, Antioch, California | 10. Traverse City Area Public Schools, Traverse City, Michigan |
| 3. Fresno Unified School District, Fresno, California | 11. Schools of the Archdiocese of St. Louis, St. Louis, Missouri |
| 4. Lynwood Unified School District, Lynwood, California | 12. Santa Rosa Consolidated Schools 8, Santa Rosa, New Mexico |
| 5. Idaho School District 25, Pocatello, Idaho | 13. Community School District 16, Brooklyn, New York |
| 6. Elkhart Community Schools, Elkhart, Indiana | 14. Buffalo Public Schools, Buffalo, New York |
| 7. Iowa City Community School District, Iowa City, Iowa | 15. Turtle Mountain Schools, Belcourt, North Dakota |
| 8. Montgomery County Public Schools, Rockville, Maryland | 16. Brazosport Independent School District, Freeport, Texas |

**1991 NSRC ELEMENTARY SCIENCE LEADERSHIP INSTITUTE
Participating School Systems**

School District	Total students	Elementary students	Elementary teachers	Elementary schools
Huntsville City School System Huntsville, AL	24,338	12,401	544	27
Antioch Unified School District Antioch, CA	13,025	7,741	348	9
Fresno Unified School District Fresno, CA	72,000	44,873	1,603	60
Lynwood Unified School District Lynwood, CA	15,550	9,800	354	9
Idaho School District 25 Pocatello, ID	13,917	7,853	334	15
Elkhart Community Schools Elkhart, IN	11,087	6,190	242	14
Iowa City Community School District Iowa City, IA	9,016	5,301	361	15
Cambridge Public Schools Cambridge, MA	7,639	5,552	518	10
Montgomery County Public Schools Rockville, MD	107,783	59,367	2,800	123
Traverse City Area Public Schools Traverse City, MI	10,261	5,991	327	17
Schools of the Archdiocese of St. Louis St. Louis, MO	59,149	45,304	2,329	167
Santa Rosa Consolidated Schools 8 Santa Rosa, NM	825	518	22	2
Community School District 16 Brooklyn, NY	11,860	9,422	331	13
Turtle Mountain School Belcourt, ND	2,079	1,642	126	3
Brazosport Independent School District Freeport, TX	12,200	6,500	330	11
TOTAL	370,729	228,455	10,569	495

NSRC Elementary Science Leadership Institute June 1992

Evaluation

Monday, June 22

For each of today's presentations please indicate your response by circling a number:

	informative				useful to me				enjoyable			
	not at all	some what	very		not at all	some what	very		not at all	some what	very	
Sessions:												
Overview of Program <i>Olive Covington</i>	1	2	3	4	1	2	3	4	1	2	3	4
Why Science? What Science? <i>Doug Lapp</i>	1	2	3	4	1	2	3	4	1	2	3	4
Identification of Science: Materials grades 1-6 <i>Joe Griffith</i>	1	2	3	4	1	2	3	4	1	2	3	4
Workshop(Butterflies) <i>Pat McGlashan</i>	1	2	3	4	1	2	3	4	1	2	3	4
Planning an Effective Elementary Science Program <i>Sally Shuler</i>	1	2	3	4	1	2	3	4	1	2	3	4

The team meeting with your resource person was designed to help you determine how you might use this person. Did you come away from the meeting knowing how you wanted to use your resource person?

How useful was this meeting?

Additional comments about today :

NSRC Elementary Science Leadership Institute June 1992

Evaluation

Tuesday, June 23

For each of today's presentations please indicate your response by circling a number:

	<u>informative</u>				<u>useful to me</u>				<u>enjoyable</u>			
	not	some	very		not	some	very		not	some	very	
	at	what		all	at	what		all	at	what		all
Sessions:												
Teaching Hands-On Science: Asking Right Question/Right Time <i>Eleanor Duckworth</i>	1	2	3	4	1	2	3	4	1	2	3	4
Workshops: CHEM <i>Mark Koker</i>	1	2	3	4	1	2	3	4	1	2	3	4
SCIS 3 <i>William McGinnis</i>	1	2	3	4	1	2	3	4	1	2	3	4
Building Support for Hands-On Programs <i>Ramon Lopez</i>	1	2	3	4	1	2	3	4	1	2	3	4
Integrating Science <i>Wendy Binder</i> <i>Debby Deal</i>	1	2	3	4	1	2	3	4	1	2	3	4

Team Session:
What did your team work on today?

Was it a useful session for you?

How did you use your resource person?

Additional comments about today:

NSRC Elementary Science Leadership Institute June 1992

Evaluation

Wednesday, June 24

For each of today's presentations please indicate your response by circling a number:

	<u>informative</u>				<u>useful to me</u>				<u>enjoyable</u>			
	not at all	some what	very		not at all	some what	very		not at all	some what	very	
Sessions:												
Elements of an Effective Teacher Education Program <i>Susan Sprague</i> <i>Becky Smith</i> <i>Bill Smith</i>	1	2	3	4	1	2	3	4	1	2	3	4
Workshops: GEMS <i>Kimi Hosoume</i>	1	2	3	4	1	2	3	4	1	2	3	4
FOSS <i>Kathy Daiker</i>	1	2	3	4	1	2	3	4	1	2	3	4
Providing Materials Support <i>Sally Shuler</i>	1	2	3	4	1	2	3	4	1	2	3	4
Trip to Fairfax County:												
• Tour	1	2	3	4	1	2	3	4	1	2	3	4
• Discussion	1	2	3	4	1	2	3	4	1	2	3	4

Did your team meet together before you came to the Institute?

If yes, in what ways was this useful?

Comments about today:

NSRC Elementary Science Leadership Institute June 1992

Evaluation

Thursday, June 25

For each of today's presentations please indicate your response by circling a number:

Sessions:	<u>informative</u>				<u>useful to me</u>				<u>enjoyable</u>			
	not	some	very		not	some	very		not	some	very	
	at	what		all	at	what		all	at	what		all
Workshops: Plant Growth												
<i>Pat McGlashan</i>	1	2	3	4	1	2	3	4	1	2	3	4
Magnets and Motors												
<i>David Hartney</i>	1	2	3	4	1	2	3	4	1	2	3	4
Assessing Student Learning												
<i>Sabra Price</i>	1	2	3	4	1	2	3	4	1	2	3	4

In what ways has the Institute helped you develop or refine your plan?

What specific materials/resources/ideas from the Leadership Institute have you found helpful in developing your plan?

In what ways has your resource person contributed to your planning?

Additional comments:

NSRC Elementary Science Leadership Institute June 1992

Evaluation

Friday, June 26

For each of today's presentations please indicate your response by circling a number:

Sessions:	informative				useful to me				enjoyable			
	not at all	some what	very		not at all	some what	very		not at all	some what	very	
	1	2	3	4	1	2	3	4	1	2	3	4
Workshop: Insights Carolee Matsumoto	1	2	3	4	1	2	3	4	1	2	3	4
Funding Sources Allen Schmieder Susan P. Snyder	1	2	3	4	1	2	3	4	1	2	3	4
Review of Action Plans	1	2	3	4	1	2	3	4	1	2	3	4

Comments:

NSRC Elementary Science Leadership Institute June 1992

Evaluation

FINAL QUESTIONNAIRE: TEAMS

Name _____ District _____

Friday, June 26

The goal of the NSRC Elementary Science Leadership Institute is to provide participants with the knowledge and skills needed to design and implement a hands-on science education program for their districts. Your feedback on how well the Institute has accomplished this will help them design future Institutes.

1. Please summarize the expectations that members of your team had of the NSRC Elementary Science Leadership Institute.

2. Describe how the Institute did or did not meet these expectations.

NSRC Elementary Science Leadership Institute June 1992

Evaluation

FINAL QUESTIONNAIRE: INDIVIDUALS

Name _____ District _____

The NSRC believes that the following 6 areas are key in bringing about change in science education. Each has been addressed to a greater or lesser extent during the Leadership Institute. For each area please indicate the following:

- Was the area covered sufficiently to meet your needs?
- What suggestions do you have for improving coverage of this area?

1. Science curriculum units appropriate for grades one through six

- Was the area covered sufficiently to meet your needs?
- What suggestions do you have for improving coverage of this area?

2. Support systems for supplying hands-on science materials and apparatus to elementary school teachers

- Was the area covered sufficiently to meet your needs?
- What suggestions do you have for improving coverage of this area?

3. Inservice education programs to prepare elementary teachers to teach hands-on science

- Was the area covered sufficiently to meet your needs?
- What suggestions do you have for improving coverage of this area?

NSRC Elementary Science Leadership Institute June 1992

Evaluation

4. Interdisciplinary approaches for integrating science instruction with other curricula

- Was the area covered sufficiently to meet your needs?
- What suggestions do you have for improving coverage of this area?

5. Assessment methods for evaluating student performance that are consistent with the goals of a hands-on elementary science program

- Was the area covered sufficiently to meet your needs?
- What suggestions do you have for improving coverage of this area?

6. Strategies for building administrative and community support for a hands-on elementary science program

- Was the area covered sufficiently to meet your needs?
- What suggestions do you have for improving coverage of this area?

NSRC Elementary Science Leadership Institute June 1992

Evaluation

Please comment on the following 3 areas:

Institute Facilities:

Living Accommodations:

Organization of Agenda:

Science Education News

Directorate for Education and Human
Resources Programs

American Association for the
Advancement of Science

News

New Guides to Accessibility Published

The AAAS Project on Science, Technology and Disability announces the publication of a series of four *Barrier-Free in Brief* booklets developed to provide technical assistance in designing meetings, classrooms, laboratories, and science activities that include people with disabilities. AAAS pioneered making scientific meetings accessible to people with disabilities.

Many times, program chairs and meetings managers request assistance in planning accessible meetings and small workshops. *Barrier-Free in Brief: Workshops and Conferences for Scientists and Engineers* reflects the experience of dozens of scientists and engineers with disabilities who have attended AAAS meetings since AAAS instituted barrier-free meetings in 1976. This booklet updates AAAS's 1976 publication *Barrier Free Meetings*. The new booklet gives suggestions on choosing accessible meeting sites and providing appropriate accommodations so that all association members can fully participate in any professional or social program.

Barrier-Free in Brief: Laboratories and Classrooms in Science and Engineering addresses specific ways to accommodate the needs of students with disabilities in classroom and laboratory environments. Each type of disability is addressed and suggestions are given for making appropriate accommodations in classrooms, labs and other settings. Resources and lab activities and a building access checklist are included.

Barrier-Free in Brief: Access to Science Literacy discusses out-of-school science programs with ideas for students, parents, and program directors for making these experiences accessible.

Correct language usage concerning people with disabilities is very important. *Barrier-Free in Brief: Access in Word and Deed* discusses the ap-

propriate terminology used in the mainstream disability community today. The book has an extensive list of consultants in disability and science.

If you would like a complimentary copy of one or all of our AAAS *Barrier-Free* booklets, please write or call Beth Goodrich, Project on Science, Technology and Disability, AAAS, 202/326-6630 (Voice/TDD).

Center Launches Project to Link Teachers and Scientists

The National Sciences Resource Center (NSRC), a cooperative venture of the Smithsonian Institution and the National Academy of Sciences, has launched a venture to improve elementary-school science by linking scientists and teachers.

Over the next four years, the National Elementary Science Leadership Institute (NESLI) will engage both educators and scientists across the country in a concerted and sustained effort to improve the teaching of science in the nation's elementary schools. Through the initiative, the NSRC will

- sponsor a series of leadership institutes to develop a talent pool of educators and scientists who can act as agents of change, leading science education reform efforts in their school districts
- provide specialized technical assistance to school districts working to improve their elementary science programs
- disseminate information on effective hands-on, inquiry-based science teaching resources and sources of expertise to people working to improve elementary science education
- stimulate policy and program changes that will lead to the improvement of science education in school districts throughout the country.

One of the project's major goals is to make school districts and communities aware of the high-quality hands-on materials produce by na-

tional elementary science materials developments projects. NESLI will also build on current efforts to examine the goals of the school science curriculum, such as the AAAS Project 2061, the National Sciences Teachers Association's Scope, Sequence, and Coordination Project, and the National Research Council's initiative to coordinate the development of K-12 science standards.

Under the project, the NSRC plans to hold two institutes annually where leadership teams composed of teachers, science coordinators, superintendents, and local scientists drawn from 30 school districts will meet to plan reform. Over the next four years, the institutes are expected to prepare as many as 520 participants, representing 120 urban, rural, and suburban districts.

NESLI is being supported by the National Science Foundation, the U.S. Department of Education, and additional corporate sponsors.

For further information about the project or for information about scientist's and engineer's participation, contact Olive Covington, National Sciences Resource Center, Arts & Industries Building, Smithsonian Institution, Washington, DC 20560; (202) 357-2555.

Announcements

Assessment Project Releases Principles and Goals for Mathematics

The Mathematical Sciences Education Board (MSEB) has just released *For Good Measure*, which documents an MSEB project to establish a framework for the establishment of national assessment standards. The project began in 1990 and included four regional meetings and a national summit held at the National Academy of Sciences in April 1991.

The report contains the agreements on principles and goals that were outlined during four regional meetings, deliberated on by some 600 attendees at the summit, and finalized shortly before the April meeting. The consensus-based principles and goals contain recommendations from educators, mathematicians, and representatives from business and industry, assessment, public policy, and parent and community groups.

The report describes three principles for mathematics assessment:

- The primary purpose of assessment is to improve learning and teaching.

- The primary use of results of assessments is to promote the develop of the talents of all people.
- The content of assessments is derived from the consensus of the discipline.

Seven goals for mathematics assessment to be reached by the year 2000 were set. These include:

- Assessments will be aligned with the mathematical knowledge, skills, and processes that the nation needs all of its students to know and to be able to do.
- Assessment practices will promote the development of mathematical power for all students.
- A variety of effective assessment methods will be used to evaluate outcomes of mathematics education.

Over the past decade, national standards for curriculum and instruction in school mathematics were developed in a comprehensive effort spearheaded by the National Council of Teachers of Mathematics. *For Good Measure* represents the beginning of the third and final area in which national standards will be developed for school mathematics.

Free copies of *For Good Measure* are available, while the supply lasts, from the Mathematical Sciences Education Board, 2101 Constitution Avenue, NW, Harris 476. Washington, DC 20418.

Children's Science Books Focus of National Forum

"Children's Books for Technological Literacy" is the theme of the 1992 National Forum on Children's Science Books (CSB'92) to be held May 1 and 2 in Pittsburgh, PA. The Forum is intended for teachers and librarians; authors, editors, and publishers; policy makers in science education; and "people who appreciate wonderment," according to its organizers.

The demand for new children's science books is growing, in part because of the confluence of two educational movements: the "whole language" approach to reading and "inquiry-based" science curricula. CSB'92 General Chair Fred Bortz of Carnegie Mellon University, suggests that "before too many more of those books are written, we ought to pause to determine how they can best contribute" to improving science education.

Bortz and his Advisory Committee envision an interactive forum in which attendees from publishing, libraries, and education will join

EDUCATION WEEK

American Education's Newspaper of Record

Volume XI, Number 15 • December 11, 1991

• 1991 Editorial Projects in Education / \$3.00

Reform Project To Link Teachers, Working Scientists

By Peter West

WASHINGTON—The Smithsonian Institution and the National Academy of Sciences have launched a venture to improve elementary-school science by linking teachers with working scientists.

The National Elementary Science Leadership Initiative, which began this month, is designed to "capitalize on the unique capacity of [the organizations] to marshal the energy of the leaders in science, education, and industry at the national, state, and local levels," according to a draft proposal for the project developed by

the National Science Resources Center, a cooperative venture of the Smithsonian and the Academy.

The six-year initiative is built around a series of "leadership institutes" that will bring educators and scientists together to share ideas about science and science teaching and to spur reform at the local level.

"It's going to be an exceedingly thorough program that links the grassroots with a leadership network at their own level," said Kathleen Holmay, a N.S.R.C. spokesman.

The program is based on a series of smaller institutes that the N.S.R.C. has held in Washington for

several years.

The Education Department, the National Science Foundation, and private science- and technology-related concerns such as the Dow Chemical Company Foundation, the Digital Equipment Corporation, and the Hewlett-Packard Company are sharing the costs of the project.

N.S.R. has pledged \$5.9 million in support over six years. The Education Department has promised \$280,000 and the corporate sponsors have offered varying amounts, a spokesman said.

Under the project, the N.S.R.C. plans to hold two institutes annually where

leadership teams composed of teachers, science coordinators, superintendents, and local scientists drawn from 30 school districts will meet to plan reform.

Over the next four years, the institutes are expected to prepare as many as 520 participants, representing 120 urban, rural, and suburban districts.

Original and Existing Reforms

And, while officials anticipate that the new initiative will encourage the local teams to create original reforms, N.S.R.C. officials said, it also is designed to support existing efforts, such as those sponsored by the National Science Teachers Association, the American Association for the Advancement of Science, and the N.S.F.

A key element of the new program will be a series of "leadership institutes for scientists," the first of which is tentatively scheduled for this spring, which will help researchers mull over the ways in which their discoveries could be melded into precollegiate teaching.

Ms. Holmay said. The two national groups will also offer technical assistance to help provide cohesiveness to the project, including setting up a telecommunications network that will allow institute alumni to share ideas and concerns.

National Science Resources Center, NESLI Report, October 1992

The Angleton Times

AR, NO 191

June 23, 1992

Established 1893

Daily 25 Cents, Sunday 50 Cents

School reps to go to seminar on sciences

Lessons focus on 'hands-on' teaching

By KEN WALKER
The Angleton Times

ANGLETON — In schools across the country, students have been learning how the world works by reading science textbooks in classrooms with the windows closed and shades drawn.

But school leaders are beginning to realize that they could better interest young students in learning science by actually letting them experience it.

The National Science Resources Center (NSRC) at the Smithsonian Institution's National Academy of Sciences will focus on that kind of "hands-on" approach in an "Elementary Science Leadership Institute" to be attended by school administrators, curriculum specialists, teachers and scientists next month.

Dr. Mary Nell Boyd, director of elementary education for Angleton schools, will be one of the five representatives from this area traveling to Washington, D.C., to attend the seminar.

"This is the new wind that's blowing through elementary science," Boyd said, "the emphasis on hands-on science — to learn science by doing science rather than just reading about it."

Boyd said the seminar will concentrate on subjects like the identification of appropriate curriculum materials for the various developmental stages of elementary students, building community support for new programs and effectively

educating teachers to run participatory programs.

The coalition of representatives from Angleton, Columbia-Brazoria, Danbury and Sweeny school districts was formed to give the representatives an edge in a competitive application process.

Although Boyd wasn't sure how many teams applied for the institutes, she said only 16 teams were accepted from a nationwide field of applicants.

"The reason we formed this coalition was to enhance our chances of being accepted," Boyd said, "because understandably the NSRC wants to reach as many schools as possible."

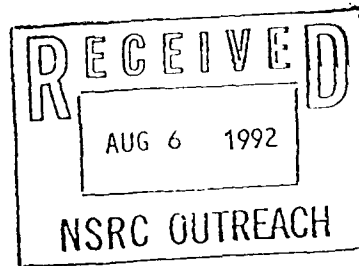
Other team members include Miriam Jordan, a Danbury Elementary School teacher; Eric Grimm, a Columbia-Brazoria ISD principal; Dianne Weiss, a Sweeny Elementary School teacher; and Ed Suazo, development manager for Dow Chemical in Texas.

Boyd said the institute will allow Angleton schools to make further advances in an elementary program which already uses participatory techniques.

"Angleton is ahead of the game," she said. "We have already started implementing hands-on science." Boyd pointed out that the district's science instruction council is currently meeting to review science programs and make changes.

"Angleton already has a good basis in hands-on science," Boyd said, "and we're working to make it better."

CENTER TO ADVANCE PRECOLLEGE SCIENCE EDUCATION
School of Dentistry



July 28, 1992

Olive W. Covington
Director of Outreach
National Science Resources Center
Arts & Industries Building, Rom 1201
Smithsonian Institution
Washington, D.C. 20560

Dear Olive,

I know exactly how you felt on the last day of the NSRC Institute! A deficit of energy... A wonderful sense of satisfaction... And, the strong desire not to think about next year!

We are in our last week of two back-to-back, partially overlapping teacher institutes for 150 elementary teachers and principals which began July 6 and will conclude this Friday, July 31. At last count, I think we were working with over thirty-five trainers and have probably caused 100's of trees to be felled. July feels like it will never end, offset, however, by the fact that my expectations have been exceeded for motivating the teachers, causing them to feel a comfort level with science, a desire for more, and giving them the skills to return to their schools with a sense of fearlessness about restructuring K-6 science education.

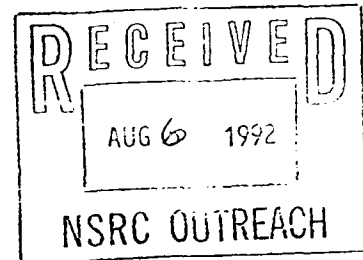
All of this is by way of sincere apology for not writing to you earlier to let you know how appreciative I am for the LAUSD team having been selected for participation in the NSRC Institute. It was the best thing, at the best time, that could have happened to LAUSD. Personally, I cannot tell you how much I respect the thought that went into the planning of the institute, the format and the thoroughness of implementation. If the best form of flattery is imitation, you should be enormously flattered! We used much of the contents of the NSRC binder to distribute to our participants; and we used cardboard boxes, not for mailing purposes, but as portfolios and portable offices during the institute (for participants' science experiments, lab notebooks, three-ring binders, etc.). And, I named my caterpillar "Olive" and she evolved into the most gorgeous butterfly!

Hal joins me in sending warm regards,

Lois Slavkin
Executive Director

REDWOOD CITY SCHOOL DISTRICT

815 Allerton Street • Redwood City • CA 94063 • (415) 365-1550
Ronald F. Crates, Ed. D., Superintendent



July 29, 1992

Olive W. Covington
Director of Outreach
National Science Resource Center
National Academy of Sciences
Smithsonian Institution
Washington, D.C. 20560

Dear Olive,

We want to again express our thanks to you and the NSRC Elementary Science Leadership Institute staff for our wonderful and fruitful experience in Washington. It gave us the time we needed to bring our hopes closer to fulfillment and truly provided the feeling that we now belong to a national network dedicated to improving science education for all students.

We hope to see you all at future "reunions" and as we work to create a love and knowledge of science in our students, will continue to inform others of the collaborative effort which your program so well embodies and provides.

Thank you again.

Sincerely yours,

Mary Lairon, Ph.D.
Assistant Superintendent



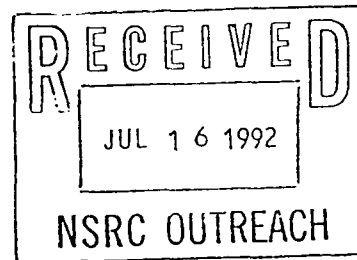
LOUISIANA SYSTEMIC INITIATIVES PROGRAM

1885 WOODDALE BOULEVARD, SUITE 900
BATON ROUGE, LA 70806
(504) 922-0690 FAX: (504) 922-0688

A COALITION FOR THE REFORM OF MATHEMATICS AND SCIENCE EDUCATION WHICH INCLUDES THE NATIONAL SCIENCE FOUNDATION, MATHEMATICS AND SCIENCE TEACHERS, THE GOVERNOR, THE LEGISLATURE, THE BOARD OF ELEMENTARY AND SECONDARY EDUCATION, AND THE BOARD OF REGENTS

July 6, 1992

Olive Covington
Director of Outreach
National Science Resources Center
Arts and Industries Building
Room 1201
Smithsonian Institution
Washington, DC 20560



Dear Olive:

I wish to express my appreciation to you, Director of Outreach of the National Science Resources Center Elementary Science Leadership Institutes, for inviting me to take part in a outreach program designed to help students develop critical thinking skills and to enhance their ability to solve problems through hands-on activities. The staff and participants were most cooperative. Information presented during the institute far exceeded my expectations. I have already begun to use and share what I learned with people in position to make change in the way science is taught in our state.

Please convey to the staff of NSRC my gratitude for their support and dedication to help prepare teams to organize and lead elementary science improvement programs in their local schools districts.

Olive, a special thanks for the warmth and care that was evident throughout the week.

Sincerely,

Celeste Pea
LaSIP Science Coordinator

Enclosure:

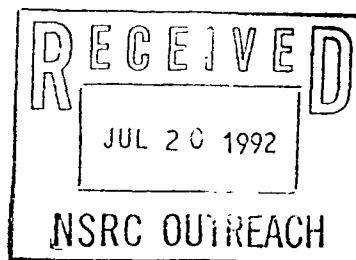


Dow U.S.A.

The Dow Chemical Company
P.O. Box 150
Plaquemine, Louisiana 70765-0150

Building 2306
July 13, 1992

Olive Covington
Director of Outreach
National Science Resources Center
Arts & Industries Building, Room 1201
Smithsonian Institution
Washington, DC 20560



Dear Olive:

I would like to thank you and your staff for our wonderful week in Washington. The information we gained from the seminars and new friends has, and will be, extremely helpful to us as we begin our hands-on science program.

I would like to apologize for not writing this letter sooner, but we have been busy with our work for the coming school year. The Iberville and West Baton Rouge groups have made presentations to the local school boards, West Baton Rouge has organized a meeting of the elementary principals, and East Baton Rouge parish will be meeting with the school board this week. We have a new Elementary Science Curriculum which will be used this coming school year. In-service for all members of both teams has been organized, so we will be better equipped to make decisions on the purchase of kits for the coming year.

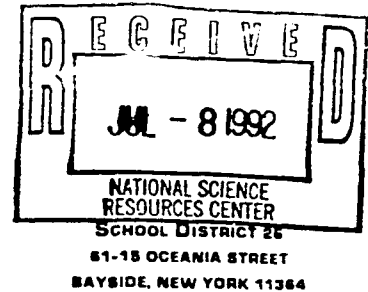
Olive, we are all very excited about this program, and feel privileged to have been included in the Leadership Institute. I will keep you posted as to our progress.

Sincerely,

Sue Blanchard
Community Relations Coordinator

BOARD OF EDUCATION
CITY OF NEW YORK
OFFICE OF THE COMMUNITY SUPERINTENDENT
IRWIN ALTMAN

ANITA E. SAUNDERS, DIRECTOR
STAFF DEVELOPMENT/FUNDED PROGRAMS
(718) 631-8882



June 30, 1992

Mr. Douglas Lapp
Executive Director
National Science Resource Center
Smithsonian Institution,
National Academy of Sciences
Arts & Industries Bldg., Rm.1201
Washington DC 20560

Dear Doug:

On behalf of my team I thank you for providing us with the opportunity of participating in the June 21-26, 1992, NSRC Leadership Institute. It was WONDERFUL! It provided us with the much needed time to gain first-hand, hands-on experience, information, validation of ideas, networking, and a feeling of hope regarding educational dreams.

We appreciated all your efforts in providing us with the BEST resources. Days and evenings were jam-packed and carefully scheduled. Olive Covington was a wonderful task master with an incredible personality and manner. We respected the no-nonsense approach, appreciating the consideration of our precious and limited amount of time. Best of all, you practiced what you preached - hands-on, active learning experiences.

For me, the hands-on Magnet/Electricity workshop was an eye opener. You see, although I was never science phobic, I knew very little on this topic. So, when I had to perform hands-on with little background knowledge, I could empathize with many teachers' feelings of inadequacy. I immediately realized the necessity of additional professional development hands-on workshops per topic and the follies of time allocation in our original plan.

Producing a draft for a District Science Professional Development Plan, that can be shared with our various constituencies (committees and the Superintendent) was, indeed, a worthwhile exercise. We worked hard - learning, experiencing, synthesizing and applying.

COLEGIO DE LA PAZ

(VIZCAINAB)
CALLE VIZCAINAB 21
MEXICO, D. F.
~~~~~

July 17th 1992.

Douglas M. Lapp  
Executive Director  
National Resource Center  
Arts and Industries Building, Room 201  
Smithsonian Institution  
Washington DC 20560

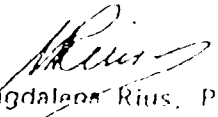
Dear Douglas:

I want to thank you and all the people that organized the 1992 Elementary Science Leadership Institute; It was a wonderful as well as interesting experience.

We are starting a program to develop the teaching of science in elementary school, so the material and information we received it's being most helpful.

Also, we are very happy about the possibility to translate into Spanish the educational materials for Carolina Biological Supply Co.

Sincerely

  
Magdalena Rius, Ph.D.

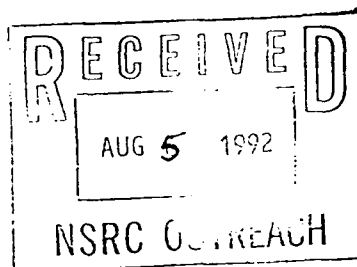


Shawnee Mission Public Schools  
Howard D. McEachen Administrative Center  
7235 Antioch  
Shawnee Mission, Kansas 66204-1798  
Telephone 913-831-1900 FAX 913-831-1450

Educating for Life

July 31, 1992

Olive W. Covington, Director of Outreach  
National Science Resources Center  
National Academy of Sciences  
Smithsonian Institution  
Arts and Industries Building  
Washington, D.C. 20560



Dear Olive,

I felt as though I knew you before I arrived because of your gracious letters. Everything seemed so well organized. I had the sense that I was in for a very special learning experience and I was right. I could not have had a more enjoyable or productive week. It was obvious that you and your staff had spent hours planning a meaningful week for the participants. You were open to feedback and modified and adjusted whenever possible. Your willingness to respond to our needs was a good model for all of us when we go back home and plan for adult learners.

I have enclosed a copy of our annual report. Please see page 10. It is an example of how we have involved scientists to support and enrich our efforts. I have also enclosed my anticipatory set for administrators before our first principals' meeting. The week we spent with you has made our leadership team even more powerful as we plan to make the instruction of science our top priority.

You are a tough task master, Olive. Our team members all agreed that if we were students in your class we would all be productive and succeed - there would be no other choice. Please accept our appreciation and pass our thanks on to your competent staff. Hopefully we will see you in Kansas City this spring. If you have time, I'd love to show you around Shawnee Mission. Thanks again for a wonderful week.

Sincerely,

*Jo-Anne Grote*

Jo-Anne Grote  
Associate Superintendent, Elementary Schools

**APPENDIX E**

**1992 WORKING CONFERENCE ON PRECOLLEGE  
SCIENCE EDUCATION FOR SCIENTISTS AND ENGINEERS  
INFORMATION**



To help scientists and engineers become effectively involved in the improvement of kindergarten through 12th grade science education, the National Science Resources Center is sponsoring a series of four annual working conferences, beginning in 1992, as part of a major national science education leadership initiative.



*"We must begin early by providing children with a challenging and stimulating introduction to science in the elementary grades—a hands-on experience that will give them a taste of real science and build an appetite for more."*

**—Frank Press, President  
National Academy of Sciences**

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## PROGRAM

Scientists and engineers participating in the conference will be selected to represent academia, business and industry, and federal research laboratories. The conference is designed to help participants identify roles they might play in improving K-12 science education. Attendees will engage in hands-on experiences with innovative science teaching materials, observe examples of effective science teaching in public school classrooms, and participate in discussions about the characteristics of successful elementary and secondary school science programs. Participants will also discuss effective roles for improving science education in the schools, including

- How to work collaboratively with school districts to help them create and sustain effective science programs
- Ways to act as advocates for the establishment of hands-on inquiry-based science programs in the local schools
- Approaches to working collaboratively with teachers to develop high-quality instructional materials and resources
- Ways to participate effectively in the in-service and pre-service education of teachers

## STAFF

The conference staff will include master elementary and secondary school science teachers, leading science educators, specialists in cognitive development and the assessment of science learning, and scientists and engineers who are engaged in projects to improve science education.



---

### ACCOMMODATIONS, MEALS, AND TRAVEL

Accommodations, continental breakfast, lunch each day, and two evening meals are provided for all participants. Participants assume responsibility for their own transportation expenses. Limited travel funds are available based on need.



*"We hear a lot these days about literacy, but we should recognize that it is a moving target. Cultural literacy without a significant and growing component of scientific and technological literacy is, for our era, as unimaginable as our civilization is without its scientific and technological aspirations and underpinnings."*

—Robert McC. Adams  
Secretary, Smithsonian Institution

### APPLICATION PROCESS

Scientists and engineers who wish to participate are invited to apply to the NSRC. Selection is primarily based on evidence of a commitment to improve precollege science education. Attendance is limited to 30 participants each year. To apply, contact:

**Director of Outreach  
National Science Resources Center  
Smithsonian Institution  
Arts & Industries Building • Room 1201  
Washington, DC 20560  
Phone: 202-287-2063 FAX 202-287-2070**



### NSRC NETWORK

The NSRC is developing a network of scientists and engineers who are working to improve science education in the schools. The NSRC Network will provide technical assistance and information sharing. To join the network, contact the NSRC Director of Outreach.



The National Science Resources Center is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hand-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, D.C.

#### SPONSORS OF NSRC PROGRAMS

Amoco Foundation  
Digital Equipment Corporation  
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The W.K. Kellogg Foundation Endowment Fund of the  
National Academy of Sciences and the Institute of Medicine

**Working Conference on Precollege  
Science Education for  
Scientists and Engineers**

**March 7-13, 1992**

***California Institute of Technology  
Pasadena, California***

 **National Science Resources Center**  
SMITHSONIAN INSTITUTION-NATIONAL ACADEMY OF SCIENCES

---

## **Working Conference on Precollege Science Education for Scientists and Engineers**

**D**evelopment of the scientific and technological literacy of our young people is critical to their future and to the future of our nation. For all young Americans to be able to achieve this goal, scientists and engineers must become actively involved in efforts to improve science education in the schools.

To help scientists and engineers become effectively involved, the National Science Resources Center is sponsoring a series of annual working conferences during the next four years as part of a major national leadership initiative that focuses on the reform of elementary science education.

The first of these conferences will be held at the California Institute of Technology in Pasadena, California, from Saturday, March 7, through Friday, March 13, 1992.

---

## **Program**

The program will provide conference participants with the opportunity to become familiar with

- approaches to science instruction that are appropriate for children in grades K-12;
- examples of exemplary science curriculum materials; and
- characteristics of effective elementary and secondary school science programs.

Attendees will engage in hands-on experiences with some innovative science teaching materials, observe examples of effective science teaching in public school classrooms, and participate in discussions with national leaders in science education reform. In addition, participants will have the opportunity to learn about roles they might play in improving science instruction in the schools, such as

- working with teachers to contribute to the development of high-quality teaching materials and resources;
- participating in the in-service and preservice education of teachers;
- working collaboratively with teachers to help them teach science more effectively;
- acting as advocates for the establishment of hands-on, inquiry-based school science programs in their local communities; and
- working collaboratively with school districts to help them create and sustain effective science programs in the schools.

## **Staff**

The conference staff will include master elementary and secondary school science teachers, leading science educators, and prominent scientists and engineers who are working to improve science education in the schools.

---

### **Application Process**

Interested scientists and engineers from academia, business and industry, and federal research facilities should send a completed application form to the NSRC no later than February 1, 1992. Selection criteria will include evidence of commitment to improve precollege science education. The NSRC also will strive to include a broad mix of participants from academia, industry, and government.

Attendance will be limited to 30 participants. Applicants will be notified of the status of their applications by February 10, 1992.

### **Accommodations and Meals**

The NSRC will provide accommodations for all participants. In addition, the NSRC will provide continental breakfast and lunch each day, as well as two evening meals.

### **Travel**

Participants will be expected to assume responsibility for their own transportation expenses. However, limited travel funds will be available based on financial need.

### **NSRC Network**

The NSRC is developing a network of scientists and engineers who are working to improve science education in the schools. If you would like to join this NSRC Network, please contact

Olive Covington  
Director of Outreach  
National Science Resources Center  
Arts and Industries Building, Rm. 1201  
Smithsonian Institution  
Washington, DC 20560; (202) 357-2555



The **National Science Resources Center** is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, D.C.

### **Sponsors of NSRC Programs**

Amoco Foundation  
Digital Equipment Corporation  
Dow Chemical Company Foundation  
E.I. du Pont de Nemours and Company  
Hewlett-Packard Company  
John D. and Catherine T. MacArthur Foundation  
National Science Foundation  
U.S. Department of Defense  
U.S. Department of Education  
The W.K. Kellogg Foundation Endowment Fund of the  
National Academy of Sciences and the Institute of Medicine



**National Science Resources Center**  
**Working Conference on Precollege Science Education**  
**for Scientists and Engineers**

**March 7-13, 1992**  
**California Institute of Technology**

**Pasadena, California**

**Application**

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Work Address: \_\_\_\_\_

\_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ ZIP: \_\_\_\_\_

Telephone: \_\_\_\_\_ Facsimile: \_\_\_\_\_

1. Describe in a paragraph or two your interests and experience related to precollege science education and why you would like to participate in this conference.  
(Use back of page if necessary.)

2. If you have already been working in precollege science education, please provide the name of someone who is familiar with this work:

Name: \_\_\_\_\_

Title: \_\_\_\_\_

2. If you have already been working in precollege science education, please provide the name of someone who is familiar with this work:

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

3. Please attach a professional résumé. (Include your social security number.)

4. Participants will be expected to assume responsibility for their own transportation expenses to the conference in Pasadena. However, limited travel funds will be available based on financial need.

☐ I will be able to provide my own transportation expenses.

☐ I will need assistance for airfare.

Send your completed application to the NSRC by February 1, 1992.  
For additional information, contact

Olive Covington, Director of Outreach  
National Science Resources Center  
Arts and Industries Building, Room 1201  
Smithsonian Institution  
Washington, DC 20560  
(202) 357-2555

Working Conference on Precollege  
Science Education for  
Scientists and Engineers

*March 8, 1992*

DINNER PROGRAM



National Science Resources Center  
SMITHSONIAN INSTITUTION—NATIONAL ACADEMY OF SCIENCES

## **Working Conference on Precollege Science Education for Scientists and Engineers**

### **Program Goals**

The National Science Resources Center is sponsoring a series of four annual working conferences to help scientists and engineers become effectively involved in efforts to improve science education in the schools. These conferences, of which this is the first, are part of the Center's major national leadership initiative that focuses on the reform of science education in the schools.

Conference attendees participate in hands-on activities to become familiar with approaches to science instruction that are appropriate for children in grades K-12; review exemplary science curriculum materials; observe examples of effective science teaching in public school classrooms; and discuss the characteristics of effective elementary and secondary school science teaching materials and programs.

These experiences provide participants with the opportunity to work with national leaders in science education reform to develop effective roles they might play in improving science instruction in their communities. These roles include

- acting as advocates for the establishment of hands-on, inquiry-based school science programs in their local communities;
- working collaboratively with school districts to help them create and sustain effective science programs in the schools;
- working with teachers to contribute to the development of high-quality teaching materials and resources;
- participating in the in-service and preservice education of teachers; and
- working collaboratively with teachers to help them teach science more effectively.

## *Reception and Dinner*

*Sunday, March 8, 1992*

The Huntington  
Library, Art Collections, and Botanical Gardens

6:45 p.m.      Reception—Garden Terrace

7:30 p.m.      Dinner—Overseers' Room

### **Welcome**

Douglas Lapp  
*Executive Director*  
National Science Resources Center

Thomas E. Everhart  
*President*  
California Institute of Technology

### **Address**

**"Teaching for Conceptual  
Understanding in Science"**

Bob Tierney  
*Science Teacher Consultant*  
National Writing Project  
University of California at Berkeley

# NSRC

The **National Science Resources Center** is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, D.C.

The National Science Resources Center is grateful to the California Institute of Technology for its assistance with this program.

## NSRC Sponsors

Amoco Foundation  
Digital Equipment Corporation  
Dow Chemical Company Foundation  
E.I. du Pont de Nemours and Company  
Hewlett-Packard Company  
John D. and Catherine T. MacArthur Foundation  
National Science Foundation  
U.S. Department of Defense  
U.S. Department of Education  
The W.K. Kellogg Foundation Endowment Fund of the  
National Academy of Sciences and the Institute of Medicine

**Working Conference on Precollege  
Science Education for  
Scientists and Engineers**

*March 12, 1992*

**DINNER PROGRAM**

## **Working Conference on Precollege Science Education for Scientist and Engineers**

### **Program Goals**

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- participating in the in-service and preservice education of teachers; and
- working collaboratively with teachers to help them teach science more effectively.



## ***Reception and Dinner***

*Thursday, March 12, 1992*

The Athenaeum  
California Institute of Technology

**6:45 p.m.      Reception—Hall of Associates**

**7:30 p.m.      Dinner—Hall of Associates**

### **Welcoming Remarks**

Douglas Lapp

*Executive Director*

National Science Resources Center

### **Address**

**"Improving Science Education: How  
Scientists and Engineers Can Help"**

Bruce Alberts

*Professor of Biochemistry and Biophysics*

University of California at San Francisco

# NSRC

The **National Science Resources Center** is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, D.C.

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National Science Foundation

U.S. Department of Defense

U.S. Department of Education

The W.K. Kellogg Foundation Endowment Fund of the  
National Academy of Sciences and the Institute of Medicine



Media only: John Barrat (202) 357-2627  
Linda St. Thomas (202) 357-2627

Jan. 6, 1992

NATIONAL SCIENCE RESOURCES CENTER ANNOUNCES WORKING CONFERENCE ON PRE-COLLEGE  
SCIENCE EDUCATION FOR SCIENTISTS AND ENGINEERS

The National Science Resources Center of the Smithsonian Institution and the National Academy of Sciences is accepting applications for participation in a working conference on pre-college science education. A group of 30 scientists and engineers will be invited to attend the conference, which will be held from Saturday, March 7 through Friday, March 13, 1992 at the California Institute of Technology in Pasadena, Calif. This is the first of four NSRC working conferences designed to help scientists and engineers become involved in the improvement of pre-college science education.

During this conference, scientists and engineers from universities, government laboratories and private industry will be introduced through hands-on experiences to some innovative science teaching materials, observe examples of effective science teaching in public school classrooms, and participate in discussions with national leaders in science education reform. Conference staff will include master elementary and secondary school science teachers, leading science educators and prominent scientists and engineers who are working to improve science education in America's schools.

The conference will explore ways participants can contribute to the development of high-quality teaching materials; participate in the education of science teachers; provide assistance and resources to classroom teachers; act

-XXXX-

SI-563-91

as advocates for the establishment of hands-on, inquiry-based science programs in the schools; and work with school districts to create and sustain effective science education programs.

The Working Conferences for Scientists and Engineers are a part of the National Elementary Science Leadership Initiative, a four-year NSRC project that is being funded by the National Science Foundation, the U.S. Department of Education, Digital Equipment Corp., Dow Chemical Co., and Hewlett-Packard Co. Through the conferences, the NSRC plans to develop a national network of scientists and engineers who are actively working to improve pre-college science education.

The NSRC is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The center collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials and sponsors outreach activities to help school districts develop and sustain effective hands-on science programs.

Scientists and engineers who would like additional information about the conference should contact Olive Covington, Director of Outreach at the NSRC, Room 1201, 900 Jefferson Drive S.W., Smithsonian Institution, Washington, D.C. 20560; Telephone (202) 357-2555. Attendance is limited to 30 participants.

# # # #

NEWS RELEASE



# California Institute of Technology

Office of Public Relations  
Pasadena, California 91125  
818/356-6256

MEDIA ADVISORY: Not for Publication

March 4, 1992

## **Caltech to Host Conference on Precollege Science Education for Scientists and Engineers**

**NEWS EDITORS:** The National Science Resources Center (NSRC) will stage a weeklong Working Conference on Precollege Science Education for Scientists and Engineers on the campus of the California Institute of Technology from March 7-13. The event at Caltech is the first of a series of annual working conferences planned during the next four years as part of a major national leadership initiative that focuses on the reform of elementary science education. This conference is not open to the public; registered attendees will be educators participating directly in the discussions and hands-on programs.

The media are invited to call or leave taped messages at Caltech for Elizabeth Hamilton at 818-356-3791 for information about the schedule of events and media access to conference programs. Among the programs will be discussions and demonstrations about curriculum development and materials, the role of scientists and engineers in elementary school classrooms, and case studies of efforts to improve elementary, middle, and high school science education. Among these case studies will be a full day (Monday, March 9) devoted to Project SEED (Science for Early Educational Development) -- a hands-on elementary school science education collaboration between the Pasadena Unified School District and Caltech. Among the presenters will be Project SEED Coordinator Jennifer Yuré, Pasadena Associate Superintendent Michael Klentschy, and two Caltech professors -- Jim Bower and Jerry Pine.

Based in Washington, D.C., the NSRC is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. It collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs.

Media Message Center: Elizabeth Hamilton  
818-356-3791

## Group Brings Scientists and Educators Together To Plot Reforms

By Peter West

PASADENA, CALIF.—Alan Lazarus remembers his first attempt at bringing his scientific expertise to bear in a public-school classroom.

In an effort to share with elementary-school teachers the knowledge he had accumulated in a lifetime as a working scientist, Mr. Lazarus, a researcher at the Massachusetts Institute of Technology, brought a simple kit of gears, pulleys, and levers to a local school to demonstrate some rudimentary principles of physics.

But the lesson, he said, "just got totally off track."

The teachers, he recalled, "had never played with levers and gears, and they were like a bunch of 4-year-old kids."

Although that lesson ended in confusion, Mr. Lazarus said he learned that the science background of elementary teachers is often sketchy, and that efforts to upgrade precollegiate science instruction must be more comprehensive than many scientists have realized.

But more important, he added, the incident strengthened his commitment to help improve science teaching and learning.

Hoping to capitalize on, and better direct, that kind of enthusiasm, the National Science Resources Center invited Mr. Lazarus and more than 30 other eminent scientists, teacher educators, classroom teachers, and researchers here to the California Institute of Technology this month to plot a strategy to help schools teach science more effectively.

In an information-packed, week-long working conference, they saw firsthand how an exemplary elementary science program works, were briefed on efforts to reform secondary school science and to develop national standards for science teaching, and heard a lecture on adolescent development from a nationally known psychologist.

The conference was the first in a series of four annual meetings that the center—a cooperative venture of the National Academy of Sciences and the Smithsonian Institution, has planned in an effort to develop a national network of scientists and engineers who are actively involved in long-term reform efforts.

"Some people already are helping, but, for various reasons, it's not working," an NSRC spokesman said. "And it's time to talk about why."

The Pasadena conference gave scientists—who are often accused of assuming that they alone know how to "fix" science education—an opportunity to hear from educators about how they can help develop new teaching aids, participate in teacher education, and act as a resource both to districts and teachers.

Many schools "need guidance from motivated individuals who have a plan," said Robert Najjar, a senior chemist with Union Carbide Industrial Gases. "But you just don't go in there and say, 'You have a problem, and we have the answer.'"

One participant noted that that statement, and similar remarks during the week, constituted a major admission for many scientists.

### Inspiring 'Fast Plants'

Conference officials explained that a primary influence on the theme of the meeting was the success in the education market of a product called "Wisconsin Fast Plants"—a rapidly growing species of *Brassica*, the genus that includes cabbages.

The plants are now a fixture in many precollegiate classrooms, but Paul H. Williams, a professor of plant pathology at the University of Wisconsin at Madison who developed the strain, said high-school teaching was the furthest thing from his mind when he developed the original "fast plant."

In an interview, Mr. Williams said he developed the plants as part of his research into how to develop rapidly growing strains of broccoli and cauliflower, which are important food crops in developing nations.

"My goal was focused on a practical material," he said. "It's an example of how an idea could be adapted to meet the needs of teachers."

Developed through a grant from the National Science Foundation and distributed by the Carolina Biological Supply Company under a license from a university-affiliated foundation, fast-plant kits have become a key component of many biology and botany courses from elementary school through college.

While NSRC officials do not expect to develop such products, they do hope that the success of fast plants will generate new ideas about cooperation between schools, researchers, government, and the private sector.

To reinforce the need for such cooperation, participants spent much of the early part of the conference focusing on problems in elementary science and visiting a classroom in the Pasadena Unified School District, which has adopted a curriculum developed at Caltech called Science for Early Educational Development.

They also heard about the realities of science teaching for younger students.

"At the elementary-school level, in many school districts, the teaching of science has virtually disappeared from the curriculum," Douglas Lapp, the NSRC's executive director, noted in his opening remarks.

### Working Together

The conference also featured presentations by teachers about the needs of middle-school science teachers and discussions about Project 2061, a reform effort of the American Association for the Advancement of Science, and the Scope, Sequence, and Coordination of Secondary School Science Project of the National Science Teachers Association.

That segment produced a heated exchange between participants and representatives of the two competing reform projects over what information should be considered integral to a successful science curriculum.

Participants seemed particularly struck by the lack of both time and money available to high-school teachers and by the administrative and disciplinary duties those teachers are typically assigned.

"If you want to get involved in high-school science, you have to understand what a high-school teacher's life is like," they were told by Arthur Eisenkraft, a physics teacher at Fox Lane High School in Bedford, N.Y.

But, participants pointed out, school districts also have much to learn about how to work with the scientific community.

"Does anybody else have the problem that the administrators do not have a science background?" Raymond B. Heath of the Sandia National Laboratory asked.

Others noted that many educators, particularly at the elementary level, have a very superficial understanding of how difficult it is to bring meaningful science into classrooms.

"I don't think that one can assume that the educational establishment



Participants in the National Science Resources Center conference observe classes at a school in Pasadena, Calif.

knows—because they're not doing it yet—what good science is," said Karen Worth, the principal investigator for the Insights Project, a curriculum-development effort at the Education Development Center in Newtown, Mass.

### Overcoming Difficulties

Many participants said, however, that they hoped that interaction among colleagues and across disciplines would begin to provide some answers to what they view as long-standing and difficult problems in science education.

Fred Begay, a Navajo Indian and a physicist at the Los Alamos National Laboratory, said he hoped to learn from experts how to improve educational opportunities on the vast Navajo reservation.

"For the Navajo, it's really one of the worst educational systems that you can think of," he said. "And, if you [know] about my background, you'll understand how bad it is."

Mr. Begay, who holds a doctorate in

physics without ever graduating from high school, argues that Native American children can learn science, but that strategies have not yet been developed to help them overcome difficult linguistic and cultural barriers to success.

Many participants, even those employed by prominent corporations and federal laboratories, also argued that high-profile rhetoric about a national commitment to science education often does not "trickle down" into practical applications.

Ramon E. Lopez, a scientist and project manager with the Johns Hopkins University's Applied Physics Laboratory in Laurel, Md., said that he has mentored some students and done some other "short-term interventions" in schools and recently offered to consult on curriculum development in two suburban Maryland counties.

But, he added, "for some of us, it's very difficult to get [release] time."

Ellen P. Metzger, an associate professor in the geology department at San Jose State University, said that, acting in isolation, she finds it difficult to bring about change.

"I feel that I should [be able to do more]," she said, "but I don't feel like I can do it."

However, Herbert D. Thier, a curriculum developer at the Lawrence Hall of Science at the University of California at Berkeley, suggested that scientists try to avoid a "global approach" to fixing precollege science instruction. Instead, he urged, scientists might take on more manageable roles, such as volunteering as a consulting science supervisor for a district that cannot afford to hire one.

At least one participant said that the conference might have saved a school partnership effort that his employer was ready to abandon.

The researcher, who asked not to be named, said his employer insisted that he attend the conference as a public-relations gesture before the project was discontinued.

He said, however, that his experience here "really lit a fire under me" to try to keep the project alive.

## Scientists, Engineers Pledge To Take Leading Role In Reform

PASADENA, CALIF.—The scientists and engineers who attended the National Science Resources Center's conference on science education here produced a set of recommendations designed to help guide reform efforts in the communities where they work as well as across the nation.

After spending six days analyzing the current state of science teaching, the 30 participants decided that "significant change in science education is necessary and significant change is possible."

The science-resources center—a joint body of the Smithsonian Institution and the National Academy of Sciences—will use the recommendations in preparing a newly launched, long-term effort dubbed the National Element-

### ary Science Leadership Initiative.

To make science education both more effective for students and more representative of the real world in which working scientists operate, conference participants recommended that scientists, not educators, should take the initiative in ensuring the development of high-quality collaborative efforts that draw together teachers, administrators, scientists, and researchers.

"Scientists and engineers must take the lead in bringing about this collaboration," they stated. "And...there is a need to recruit stars of talent to become engaged in the process."

### of science education at the district level.

But conference also stressed that scientists should actively participate in the national standards-setting process for science curriculum, teaching, and assessment that has been undertaken by the national academy's Coordinating Council for Education.

### No 'One Shot' Plans

The group also concluded that: "Short-term, 'one-shot off the shelf' to improve science education should be avoided and that scientists should be encouraged to volunteer to teach classes and to play a 'key role' in in-service teacher education."

### parents, and local business and industry."

A "critical need" exists to develop a "how-to" manual of inquiry-based science curriculum materials for middle and high schools and that such materials can most effectively be produced through "collaborative efforts" of scientists and teachers.

There is a related need to produce complex, alternative forms of assessment that, while incorporating some multiple-choice elements, must work to develop "higher-order thinking" in students. Scientists should play a prominent role in developing national in-service education programs.

# Science Education News

**Directorate for Education and Human  
Resources Programs**

**American Association for the  
Advancement of Science**

## NEWS

### Statewide Systemic Initiative Awards Announced

Ten states and one commonwealth have been selected to receive funds for system-wide reform of their mathematics and science education programs from kindergarten through the undergraduate level the National Science Foundation (NSF) announced May 1.

The matching awards, totalling \$100 million for up to five years, are the second in the SSI program. The first awards were made in 1991.

Proposals from the ten states and one commonwealth selected for funding — California, Georgia, Kentucky, Maine, Massachusetts, Michigan, New Mexico, Puerto Rico, Texas, Vermont, and Virginia — demonstrated a rich variety of integrated and well-coordinated plans to address major components of the states' educational systems.

Each project also will involve a partnership of executive, legislative, educational, business, and public leadership.

Such states as California and Michigan are targeting SSI funds to schools with a large number of disadvantaged students, and coordinating science and mathematics courses by establishing state guidelines or frameworks. Puerto Rico and New Mexico are also targeting minority students and female students to increase their participation in science and mathematics courses.

One result of the SSI program is that teachers and students will spend time in research laboratories, giving them opportunities to see both the potential and limitations of science and mathematics in solving real-world problems. For example, scientists from the U.S. Department of Energy Laboratory in Virginia will develop partnerships with schools and analyze global data obtained from satellites. Laboratory scientists in New Mexico will spend time each week in classrooms as ongoing consultants to teachers and schools. In Massachusetts, Georgia, and Vermont, partnerships between schools and high-tech firms

such as IBM and New England Telephone will bring scientists and the latest technologies and equipment into classrooms for teachers and students.

As classroom teaching changes, the methods states use to assess student achievement must also change. Vermont, for example, is changing from multiple-choice tests to tests that require students to perform scientific activities, while predicting the outcome and analyzing the results. States with major reform efforts underway, such as Kentucky, Maine, and Texas, will use SSI funds to pilot-test assessment and curriculum reforms in mathematics and science.

NSF funding will be phased out after the agreed-upon project term. At that time system-wide changes would be supported through long-term fiscal commitments from state legislatures and other sources, public and private, to assure that the reforms begun under this program will become permanent.

### Conference Explores Scientists' Role in Education Reform

The National Science Resources Center of the Smithsonian Institution and the National Academy of Sciences convened the first of its four working conferences designed to help scientists and engineers become involved in the improvement of K-12 science education. Thirty scientists and engineers from academia, federal research facilities, and private industry attended the March meeting.

During the week-long conference, participants worked with a variety of innovative science teaching materials, observed hands-on science teaching and learning, and participated in discussion with national leaders in science education reform. In small group discussions and plenary sessions, participants examined ways scientists and engineers can contribute to the development of high-quality teaching materials; participate in the preservice and inservice education of science teachers; act as

advocates for the establishment of hands-on, inquiry-based science programs; and work with school districts to create and sustain effective science education programs.

The conference consensus was that "significant change in science education is needed and significant change is possible." Change is possible if scientific and engineering communities become involved in alliances. These alliances should have as their goal the effective collaboration of teachers, scientists, and engineers to bring about systemic reforms in science education. Among the twelve recommendations from the conference are:

- In all science education improvement efforts, it is essential to build a local base of political support that includes teachers, scientists, parents, and local business and industry.
- Scientists and engineers should look for opportunities to become involved in such systemic reform efforts.
- High quality science curriculum materials can be most effectively produced through the collaborative efforts of teachers and scientists.
- Scientists and engineers can play a critical role in providing inservice education programs for science teachers.

In addition to three other working conferences, the NSRC is developing a network to share information and provide technical assistance to scientists, engineers, and science educators who are actively working to improve K-12 science education. These activities are part of the National Elementary Science Leadership Initiative, a four-year NSRC project funded by the National Science Foundation, the U.S. Department of Education, and additional corporate sponsors. For details, contact Olive Covington, NSRC, Arts and Industry Building, Smithsonian Institution, Washington, DC 20560; (202)357-2555.

## ANNOUNCEMENTS

### Coalition Launches Drive to Steer Minorities Into Science

A minority advocacy group recently unveiled a national campaign to increase the number of minority students preparing for science and engineering careers.

With a goal of raising nearly \$18 million by the end of the decade to support minority scholarships and fellowships and to bolster research at historically black colleges and universities (HBCU), the Quality Education for Minorities (QEM) Network

is offering many solutions to the underrepresentation of minorities in science and engineering.

QEM's action agenda, "Together We Can Make It Work," says it will try to raise \$17.6 million from colleges and universities, federal and state agencies, industry, foundations, and individuals to increase the funding of existing programs encouraging minorities to enter science and engineering.

QEM officials said they plan a national fundraising effort, a lobbying campaign, and outreach to predominantly white colleges and universities to intensify efforts encouraging science achievement at all levels.

Federal agencies to be targeted include the U.S. departments of education, energy, and defense, the National Aeronautics and Space Administration, and the Federal Coordinating Council for Science, Engineering, and Technology.

With new funding, QEM says it aims to

- Quadruple the number of minority students earning mathematics, science, and engineering scholarships annually from about 17,000 in 1987 to 68,000 by 2000
- Triple the number of minorities receiving doctorates in those fields, from 389 in 1987 to about 1,200 by 2000
- Quintuple the number of minority college graduates who enter teaching, from some 6,000 in 1986 to 30,000 in 2000, with at least a third teaching mathematics and science, and
- Increase the investment in research facilities at HBCUs and create higher education networks to guide minority students into academic, research, and teaching careers.

Single copies of the report are free from Quality Education for Minorities Network, 1818 M Street, NW, Suite 350, Washington, DC 20036.

### NCTM to Publish Resource Directory

The National Council of Teachers of Mathematics' (NCTM) Committee for a Comprehensive Mathematics Education of Every Child (C-ME) is compiling a resource directory of organizations that support underrepresented populations in mathematics education. The committee is calling for names of such organizations and contact persons, including addresses and telephone numbers.

The committee is particularly interested in programs and initiatives that have local impact. No group is too small to be recognized. After the



# SECTION NEWS

## SPACE PHYSICS & AERONOMY



Editor: Edgar Bering III, University of Houston, Department of Physics, Houston, TX 77204-5504, tel. 713-749-2848

### Workshop on Precollege Science Education

Precollege science education is an issue with profound import for the future of our country. An effective program requires the active participation of the scientific community. Thirty-one scientists and engineers from various disciplines (government laboratories, industry, and universities) met on the campus March 7-13 for a working conference on this issue. The workshop was sponsored by the National Science Resources Center (NSRC) and hosted by Jerome Pine and Jim Bower of Caltech.

The NSRC was jointly established in 1985 by the National Academy of Sciences and the Smithsonian Institution. It has emerged as a focal point for reform in precollege science education. Although the NSRC has held three workshops for teams from school districts from around the country to help them map out their plans for restructuring science education, this one was the first in a series of workshops specifically for scientists and engineers. The scientists were selected from a large group of applicants based on their prior involvement in precollege education and their potential for future contributions. Among the participants were four Space Physics and Astronomy AGU members—Alan Lazarus, Ramon Lopez, Michael Silevitch, and Bruce Tsurutani—were among the participants. In addition to the scientists and engineers, a number of experts in child development and precollege education invited

by the NSRC also participated and provided a wealth of information.

The workshop began with a detailed look at science education in the K-6 regime, with presentations on the cognitive development of elementary school children, new developments in elementary school science teaching, and a review of the finest educational materials available. A common theme in these discussions was the importance of a hands-on, inquiry-based approach to science education. The efficacy of such a pedagogical model was demonstrated during visits to Pasadena elementary schools.

Despite pockets of wealth in the city, the Pasadena school district as a whole is not particularly well-endowed, and the school population is primarily minority students (about two-thirds Hispanic). Five years ago, Pine and Bower, in conjunction with the Pasadena Unified School District, began project SEED (Science for Early Educational Development), which provides the infrastructure and teacher-training needed to operate an effective hands-on science program. The effect was striking. Children who under other circumstances probably would have been turned off to science, instead were engaged in and enthusiastic about the subject. Moreover, other subjects, such as mathematics and language arts, were integrated into the science curriculum, giving added relevance to all subjects.

Issues relevant to secondary education (middle school and high school) were also discussed. Although many aspects of secondary education are quite different from those in K-6, the basic thrust of what constitutes effective science education remains the same. In contrast, however, to the fairly complete set of curricular materials available for elementary education, there is a relative dearth of hands-on secondary science materials. The central theme that emerged from the workshop was the concept of systemic change. This concept calls for restructuring precollege science education based on an inquiry-oriented, hands-on approach, as opposed to the traditional textbook approach. It also requires the institutionalization of the program by providing infrastructure (a science materials center and other facilities) and teacher training to improve the teachers' scientific knowledge and "comfort level," as

well as to introduce teachers to new pedagogical methods.

Scientists may play a role in this effort by working with the school district to validate the program (is it good science?) and assisting in teacher training. They may also aid in developing new materials, especially at the secondary level. However, it is critical that scientists become educated about the issues in question. If scientists are to help in developing educational materials, it is essential that they learn about the materials already available in order not to reinvent the wheel (as often happens), as well as to be aware of the most effective instructional models and to understand what constitutes appropriate subject material for a given age-group. Similarly, if scientists are to be effective agents within the schools, they must have some knowledge of how to interact with school districts and the people in them. In particular, they must recognize teachers and administrators as professional equals, work with them in a collegial fashion, and be sensitive to the restraints and special problems faced by those who educate our children. The NSRC workshops for scientists will play a significant role in helping to bring this information to the scientific community.

AGU's Space Physics and Astronomy section AGU can play an important part in science education reform, and an Education Committee has been formed within SPA to

act as a focal point for science education efforts related to our discipline. Children have a fascination with space that is rivaled only by their interest in dinosaurs. Moreover, space science is intimately associated with exploration and discovery, which are the primary emotional motivators for science. Thus, space science is a unique tool for stimulating interest in science as a whole, and it can also serve as one of the vehicles for teaching science. Moreover, many of us have children ourselves, making their education more than an abstract concern.

One of the goals of the SPA Education Committee is to bring to our community the information it needs to be effective. We are planning to hold a workshop similar to the NSRC meeting (with the technical support of the NSRC) that will serve as an important vehicle for disseminating information. This workshop, which will be announced soon in *Eos*, will only mark the beginning of a process by which we will enable interested SPA members to be effective agents for quality science education. Our involvement will ensure that space physics is not ignored in the schools—so that one day, when high school students are asked, "What is the biggest object in the solar system?" they will respond: "That's easy—Jupiter's magnetosphere."—  
*Ramon E. Lopez, University of Maryland, Astronomy Department*

## G E O D E S Y



Editor: John Beavan, Lamont-Doherty Geological Observatory of Columbia University, Palisades, NY 10964; tel. 914-359-2900 ext. 282

### What Is DOSE?

NASA's Crustal Dynamics Project (CDP) spearheaded a major scientific and engineering effort over the last decade to develop and apply space geodetic techniques such as Very Long Baseline Interferometry (VLBI) and Satellite Laser Ranging (SLR) to a wide range of problems in the Earth sciences. Major study areas included plate motion, broad scale crustal deformation, polar motion, and variation in the Earth's rotation rate. Observations were initiated all over the world in collaboration with international scientists and agencies, while university and other scientists in this country received funding for research projects utilizing the new data. Numerous accomplishments over the lifetime of the CDP (to be summarized in an upcoming AGU monograph) include an order of magnitude improvement in the accuracy of space geodetic measurements; monitoring varia-

tions in the Earth's pole position and rotation rate with astounding resolution, leading to greatly improved understanding of the underlying physics; and demonstration of a remarkable consistency in plate velocities from geodetic (decadal) to geologic (several million-year) time scales.

The CDP formally ended in 1991, and many scientists in the geodetic and geophysical communities have been wondering what NASA's plans are for follow-on projects. In particular, are the spectacular technical and scientific achievements in VLBI and SLR to be abandoned just when they have reached a critical maturity for making certain types of measurements? Are the time-series of geodetic baseline changes to be truncated just when interesting trends have started being observed and quantified with increasing rigor? What is the proper role of the Global Positioning System (GPS) in the new mix of space geodetic techniques? How does GPS compare in terms of precision and accuracy to its more mature cousins, VLBI and SLR? What levels of funding for small-science projects can researchers expect from NASA in the field of space geodesy?

The answers to at least some of these questions may be found in a new program termed Dynamics of the Solid Earth (DOSE), sponsored by NASA's Solid Earth Science Branch. The DOSE program aims to exploit specific advances resulting from the CDP and other NASA activities, opening new avenues of research in such areas as plate

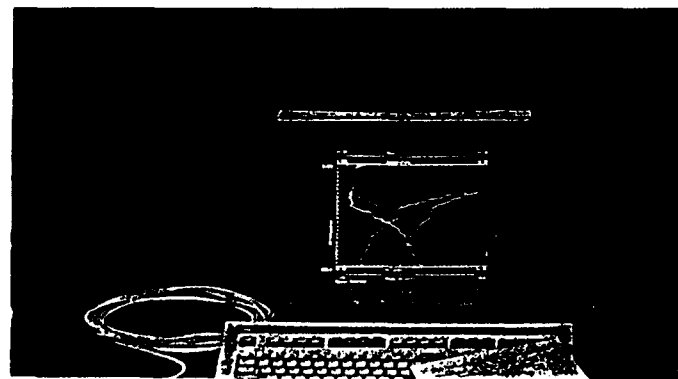
### Ozone (cont. from page 275)

chemical reactions similar to those that create the Antarctic ozone hole. The aerosols help to reduce the amount of reactive nitrogen in the stratosphere, enabling more active chlorine to be generated, which can go on to destroy ozone.

After the last big sulfur-expelling eruption

looked with Stolarski at total ozone after the eruptions of both El Chichón and Pinatubo, reported "no unique volcanic signature" at mid-latitudes.

The explanation may be that the chlorine-freezing reactions on the aerosols need colder temperatures to work, according to David Hofmann of the National Oceanic and Atmospheric Administration's Climate Moni-



OS. TRANSACTIONS. AMERICAN GEOPHYSICAL UNION

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## Science Scope

# Scientists study a sprouting SEED

By Jane Gillett  
Staff Writer

PASADENA — Scientists and engineers from across the country took a close look Monday at a hands-on science program in the Pasadena Unified School District in order to learn how they can help students in their own communities.

On the third day of a seven-day conference at Caltech on public school science education, 30 scientists visited Field, Jefferson and Cleveland elementary schools to examine the Pasadena schools' Project SEED.

Designed by Caltech professors Jim Bower and Jerry Pine, Project SEED (Science for Early Educational Development) started three years ago in one elementary school. Now it has expanded to all 21 PUSD elementary schools, has won more than \$1 million in grants and has become a national model.

"It's really unusual to see that many first graders actually hearing and doing with so little direction. The children are learning and they don't need so much

discipline," said Jan Tuomi of UC San Francisco after visiting a SEED class at Cleveland.

Tuomi reported at the conference Monday on her university's involvement in San Francisco's Science and Health Education Partnership, which she serves as science coordinator.

"SEED is significant because it's doing the right thing," said Douglas Lapp, executive director of the National Science Resource Center in Washington, D.C., a partnership between the Smithsonian Institution and the National Academy of Sciences.

SEED, which PUSD operates in partnership with Caltech, has involved scientists in developing its curriculum, something many science programs have failed to do, Lapp said.

"What I like especially about SEED is that the scientists have been careful to select a role that is not intrusive or arrogant. Too often the first impulse is to take over. Scientists know science, but sometimes they know very little about teaching. The scientists are there as a resource, but the teachers have control."

Lapp said he hoped scientists and engineers would leave the conference inspired to get involved in their own community schools to improve the ways that science is taught in public schools.

"Public education is often the whipping boy, and that rubs off on academia," he said. "Scientists think, 'It's not worth my time.' But it takes some respected scientists to change education."

Michael Silevitch, professor of electrical and computer engineering at Northeastern University in Boston, said his institution also sponsors a Project SEED in local high schools, though the acronym there stands for Science Education Through Experiment and Demonstration. He hopes to take back to Northeastern an awareness of what's happening in elementary science education, he said.

"Whatever happens has to happen from within, and the teachers here are being empowered. They can network. They are getting their hands dirty," he said.

**Working Conference  
on Precollege Science Education  
for Scientists and Engineers**

**March 7-13, 1992**

**California Institute of Technology  
Pasadena, California**

**PROGRAM**

**Working Conference  
on Precollege Science Education  
for Scientists and Engineers**

**PROGRAM**

**The National Science Resources Center is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, D.C.**

## **Working Conference on Precollege Science Education for Scientists and Engineers**

### **Program Goals**

The National Science Resources Center is sponsoring a series of four annual working conferences to help scientists and engineers become effectively involved in efforts to improve science education in the schools. These conferences, of which this is the first, are part of the National Elementary Science Leadership Initiative, the Center's national leadership development effort that focuses on the reform of science education in the schools.

Conference attendees participate in hands-on activities to become familiar with approaches to science instruction that are appropriate for children in grades K-12; review exemplary science curriculum materials; observe examples of effective science teaching in public school classrooms; and discuss the characteristics of effective elementary and secondary school science teaching materials and programs.

These experiences provide participants with the opportunity to work with national leaders in science education reform and to develop effective roles for improving science instruction in their communities. These roles include

- acting as advocates for the establishment of hands-on, inquiry-based school science programs in local communities;
- working collaboratively with school districts to help create and sustain effective science programs in the schools;
- working with teachers to contribute to the development of high-quality teaching materials and resources;
- participating in the in-service and preservice education of teachers; and
- working collaboratively with teachers to help teach science more effectively.

### **NSRC Sponsors**

Amoco Foundation  
Digital Equipment Corporation  
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Hewlett-Packard Company  
John D. and Catherine T. MacArthur Foundation  
National Science Foundation  
U.S. Department of Defense  
U.S. Department of Education  
The W.K. Kellogg Foundation Endowment Fund  
of the National Academy of Sciences and the Institute of Medicine

**Saturday, March 7, 1992**

**California Institute of Technology  
Braun Laboratory  
Conference Room 151**

**1:00 p.m.**

**Registration**

**2:00 p.m.**

**Welcoming Remarks**

Douglas Lapp  
*Executive Director*  
National Science Resources Center

Jerry Pine  
*Professor of Physics*  
California Institute of Technology

**Introduction of Participants and Staff**

Olive Covington  
*Director of Outreach*  
National Science Resources Center

**Overview of Program**

Sally Shuler  
*Deputy Director*  
National Science Resources Center

**3:15 p.m.**

**Break**

## Elementary School Science

- 3:30 p.m.**                      **Goals for Science Instruction in  
Elementary Schools**
- Doug Lapp
- 4:15 p.m.**                      **New Developments in Elementary Science  
*Insights* Curriculum Project  
Education Development Center (EDC)**
- Karen Worth  
*Principal Investigator  
Insights Project  
Education Development Center, Inc.*
- Discussion
- 5:30 p.m.**                      **Adjournment**



**Sunday, March 8, 1992**

**California Institute of Technology  
Braun Laboratory  
Conference Room 151**

**Elementary School Science**

|                   |                                                                                                                                                                                                                                 |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>8:00 a.m.</b>  | <b>Breakfast</b><br><br>Chandler Hall Cafeteria                                                                                                                                                                                 |
| <b>9:00 a.m.</b>  | <b>Elementary School Children:<br/>Who Are They and How Do They Learn?</b><br><br>Karen Worth<br><i>Faculty</i><br>Wheelock College<br>Boston, Massachusetts                                                                    |
| <b>9:45 a.m.</b>  | <b>New Developments in Elementary Science<br/>(continued)</b><br><i>Science and Technology for Children (STC)</i><br>Curriculum Project<br>National Science Resources Center<br><br>Doug Lapp<br>Sally Shuler<br><br>Discussion |
| <b>11:00 a.m.</b> | <b>Break</b>                                                                                                                                                                                                                    |
| <b>11:15 a.m.</b> | <b>Elements of an Effective Elementary<br/>Science Program</b><br><br>Sally Shuler                                                                                                                                              |
| <b>12:00 noon</b> | <b>Lunch</b>                                                                                                                                                                                                                    |

|                  |                                                                                                                                                                                                                                                            |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1:15 p.m.</b> | <b>New Developments in Elementary Science</b><br>(continued)<br><i>Full Option Science System</i> (FOSS)<br>Curriculum Project<br>Lawrence Hall of Science<br><br>Laurence Malone<br><i>FOSS Coordinator</i><br>Lawrence Hall of Science<br><br>Discussion |
| <b>2:30 p.m.</b> | <b>Work Session: Review of Elementary Science Curriculum Materials</b><br><br>Note: This session will take place in<br>Norman Church Laboratory,<br>Kerkhoff 102                                                                                           |
| <b>4:15 p.m.</b> | <b>Plenary Session: Discussion of Elementary Science Curriculum Issues</b><br><br>Facilitator<br><br>Doug Lapp                                                                                                                                             |
| <b>5:30 p.m.</b> | <b>Adjournment</b>                                                                                                                                                                                                                                         |

6:45 p.m.

**Reception and Dinner**

The Huntington—  
Library, Art Collections, and Botanical Gardens

**Welcome**

Thomas E. Everhart  
*President*  
California Institute of Technology

**Keynote Address**

Bob Tierney  
*Science Teacher Consultant*  
National Writing Project  
University of California at Berkeley

**Monday, March 9, 1992**

**California Institute of Technology  
Braun Laboratory  
Conference Room 151**

**Elementary School Science**

|                   |                                                                                                                                                                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>8:00 a.m.</b>  | <b>Breakfast</b><br><br>Chandler Hall Cafeteria                                                                                                                                                                                                |
| <b>9:00 a.m.</b>  | <b>Overview of Pasadena Unified School District<br/>Elementary Science Program</b><br><br>Jennifer Yuré<br><i>Coordinator</i><br><i>Science for Early Educational Development</i><br><i>(SEED) Project</i><br>Pasadena Unified School District |
| <b>10:00 a.m.</b> | <b>Visit to Elementary School Classrooms</b><br>Pasadena Unified School District                                                                                                                                                               |
| <b>12:30 noon</b> | <b>Lunch</b>                                                                                                                                                                                                                                   |

1:15 p.m.

**Case Studies of Efforts to Improve Elementary  
School Science**

**I. Project SEED**

**Pasadena Unified School District/  
California Institute of Technology**

**Jennifer Yuré**  
*Coordinator, Project SEED*  
Pasadena Unified School District

**Jim Bower**  
*Assistant Professor of Biology*  
California Institute of Technology

**Michael Klentschy**  
*Associate Superintendent, Instruction*  
Pasadena Unified School District

**Jerry Pine**  
*Professor of Physics*  
California Institute of Technology

**Discussion**

2:15 p.m.

**II. Science and Health Education  
Partnership (SEP)**

**San Francisco Unified  
School District/University of  
California at San Francisco  
Medical School**

**Jan Tuomi**  
*City Science Coordinator*  
Science and Health Education Partnership  
San Francisco

**Margaret Clark**  
*Professor-in-Residence*  
Cancer Research Institute  
University of California at  
San Francisco Medical School

**Discussion**

3:15 p.m.

**Break**

3:30 p.m.

**III. Elementary Science Collaborative**  
**Midland Public Schools/Dow**  
**Chemical Company**

Sarah Lindsey  
*Science Coordinator/Director*  
Science Resource Center  
Midland Public Schools  
Midland, Michigan

Jan Loveless  
*Manager of Education Affairs*  
Dow Chemical Company  
Pittsburg, California

**Discussion**

4:30 p.m.

**IV. Pioneers in Elementary Science Reform**

Charles Hardy  
*Assistant Superintendent, Instruction and Curriculum*  
Highline Public Schools  
Seattle, Washington

Susan Sprague  
*Director, Association of Science Materials Centers*  
*(ASMC) and*  
*Director, Science/Social Sciences (K-12)*  
Mesa Public Schools  
Mesa, Arizona

**Discussion**

5:30 p.m.

**Adjournment**

**Tuesday, March 10, 1992**

**California Institute of Technology  
Braun Laboratory  
Conference Room 151**

**Elementary School Science**

|                   |                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>8:00 a.m.</b>  | <b>Breakfast</b><br><br>Chandler Hall Cafeteria                                                                                                                                                                                                                                                                                                                                                   |
| <b>9:00 a.m.</b>  | <b>Work Session: Roles for Scientists and<br/>Engineers in the Improvement of Elementary<br/>School Science (Small Group Discussions)</b><br><br><ul style="list-style-type: none"><li>● What strategies have you tried?</li><li>● Which were most successful?</li><li>● What was the long-term impact?</li><li>● Which were least successful?</li><li>● What lessons have you learned?</li></ul> |
| <b>10:45 a.m.</b> | <b>Break</b>                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>11:00 a.m.</b> | <b>Plenary Session</b><br><br><ul style="list-style-type: none"><li>● Reports from Groups</li><li>● Discussion</li></ul><br>Facilitator<br><br>Sally Shuler                                                                                                                                                                                                                                       |
| <b>12:00 noon</b> | <b>Lunch</b>                                                                                                                                                                                                                                                                                                                                                                                      |

## **Secondary School Science**

- 1:15 p.m.**                      **Overview of Science Teaching in  
Secondary Schools**
- Doug Lapp
- 1:45 p.m.**                      **Adolescents: Who Are They and How Do  
They Learn?**
- David Elkind  
*Professor of Child Study*  
Tufts University
- 2:45 p.m.**                      **Break**
- 3:00 p.m.**                      **Panel Discussion: What Is the Situation in  
Middle School Science Classrooms?**
- Harold Pratt  
*Former Executive Director, Curriculum*  
Jefferson County Public Schools, Colorado
- Bill Carne  
*Science Department Chairperson*  
Parker Middle School  
Reading, Massachusetts
- Debbie Jones  
*Science Curriculum Specialist and  
Former Middle School Science Teacher*  
Fairfax County Public Schools, Virginia



**4:15 p.m.**

**Case Study of an Effort to Improve  
Middle School Science**

**Chemical Education for Public Understanding  
Program (CEPUP)**

**Lawrence Hall of Science**

**Herb Thier  
Director, CEPUP  
Lawrence Hall of Science**

**Glenn Affleck  
Production Section Manager  
Scientific Instruments Division  
Hewlett-Packard Company**

**Discussion**

**5:30 p.m.**

**Adjournment**

**5:45 p.m.**

**Reception**

**SEED House  
287 Hill Avenue**

**Wednesday, March 11, 1992**

**California Institute of Technology  
Braun Laboratory  
Conference Room 151**

**Secondary School Science**

**8:00 a.m.**

**Breakfast**

Chandler Hall Cafeteria

**9:00 a.m.**

**Panel Discussion: What Is the Situation  
in High School Science Classrooms?**

Harold Pratt  
*Former Executive Director, Curriculum*  
Jefferson County Public Schools, Colorado

Arthur Eisenkraft  
*Physics Teacher*  
Fox Lane High School  
Bedford, NY

Maria Alicia Lopez-Freeman  
*Chemistry Teacher*  
Montebello High School  
Montebello, California

Ken Bingman  
*Biology Teacher*  
Shawnee Mission West High School  
Shawnee Mission, Kansas

**10:30 a.m.**

**Break**

|                   |                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>10:45 a.m.</b> | <b>Case Studies of Efforts to Improve<br/>High School Science</b><br><br><b>I. <u>Chemistry in the Community</u> (ChemCom)</b><br><br>Dwaine Eubanks<br><i>Director, Division of Chemical Education<br/>Examination Institute<br/>American Chemical Society</i><br><br>Lucy Pryde<br><i>Chairman, Division of Chemical Education<br/>American Chemical Society</i><br><br>Discussion |
| <b>12:00 noon</b> | <b>Lunch</b>                                                                                                                                                                                                                                                                                                                                                                         |
| <b>1:15 p.m.</b>  | <b>II. <u>Microcomputer-Based Laboratory</u> (MBL)<br/>Project</b><br><br>Robert Tinker<br><i>Chief Science Officer<br/>Technical Education<br/>Research Center, Inc.<br/>Cambridge, Massachusetts</i><br><br>Discussion                                                                                                                                                             |
| <b>2:45 p.m.</b>  | <b>Plenary Session: Discussion of Secondary<br/>School Science Curriculum Issues</b><br><br>Facilitator<br><br>Sally Shuler                                                                                                                                                                                                                                                          |

**3:30 p.m.**

**Reconceptualizing the Science Curriculum**

● ***Project 2061***

Walter Gillespie  
*Deputy Director, Project 2061*  
American Association for the  
Advancement of Science

● ***Scope, Sequence and Coordination (SSC)***  
***Project***

Russell Aiuto  
*Director, Research and Development*  
Scope, Sequence, and Coordination Project  
National Science Teachers Association

**5:30 p.m.**

**Adjournment**

**8:00 p.m.**

**Workshop on Microcomputer-Based Laboratory**  
**(optional)**

Robert Tinker  
*Chief Science Officer*  
Technical Education  
Research Center, Inc.  
Cambridge, Massachusetts

**Thursday, March 12, 1992**

**California Institute of Technology  
Braun Laboratory  
Conference Room 151**

**Secondary School Science**

**8:00 a.m.**

**Breakfast**

Chandler Hall Cafeteria

**9:00 a.m.**

**Case Studies of Efforts to Improve High  
School Science (continued)**

**III. Wisconsin Fast Plants Project<sup>TM</sup>**

Paul Williams  
*Professor of Plant Pathology and  
Director, Center for Biology Education  
University of Wisconsin at Madison*

**Discussion**

**10:15 a.m.**

**Break**

**10:30 a.m.**

**IV. Woodrow Wilson National Fellowship  
Foundation Leadership and Outreach  
Program**

Carlo Parravano  
*Chairman  
Division of Natural Sciences  
State University of New York at Purchase*

**Discussion**

**11:45 p.m.**

**Lunch**

## **Secondary School Science**

- 1:00 p.m.**                      **The Development of National Standards for Science Education**
- Kenneth M. Hoffman  
*Associate Executive Officer for Education*  
Coordinating Council for Education  
National Research Council
- Discussion**
- 2:00 p.m.**                      **New Frontiers in the Assessment of Student Learning in Science**
- Richard Shavelson  
*Dean, Graduate School of Education*  
University of California at Santa Barbara
- 3:00 p.m.**                      **Break**
- 3:15 p.m.**                      **Work Session: Roles for Scientists and Engineers in the Improvement of Secondary School Science (Small Group Discussions)**
- What strategies have you tried?
  - Which were most successful?
  - What was the long-term impact?
  - Which were least successful?
  - What lessons have you learned?
- 4:45 p.m.**                      **Plenary Session**
- Reports from Groups
  - Discussion
- Facilitator**
- Doug Lapp
- 5:30 p.m.**                      **Adjournment**

**6:45 p.m.**

**Reception and Dinner**

**The Athenaeum**

**Improving Science Education:  
How Scientists Can Help**

**Bruce Alberts**  
*Professor of Biochemistry and Biophysics*  
University of California at San Francisco

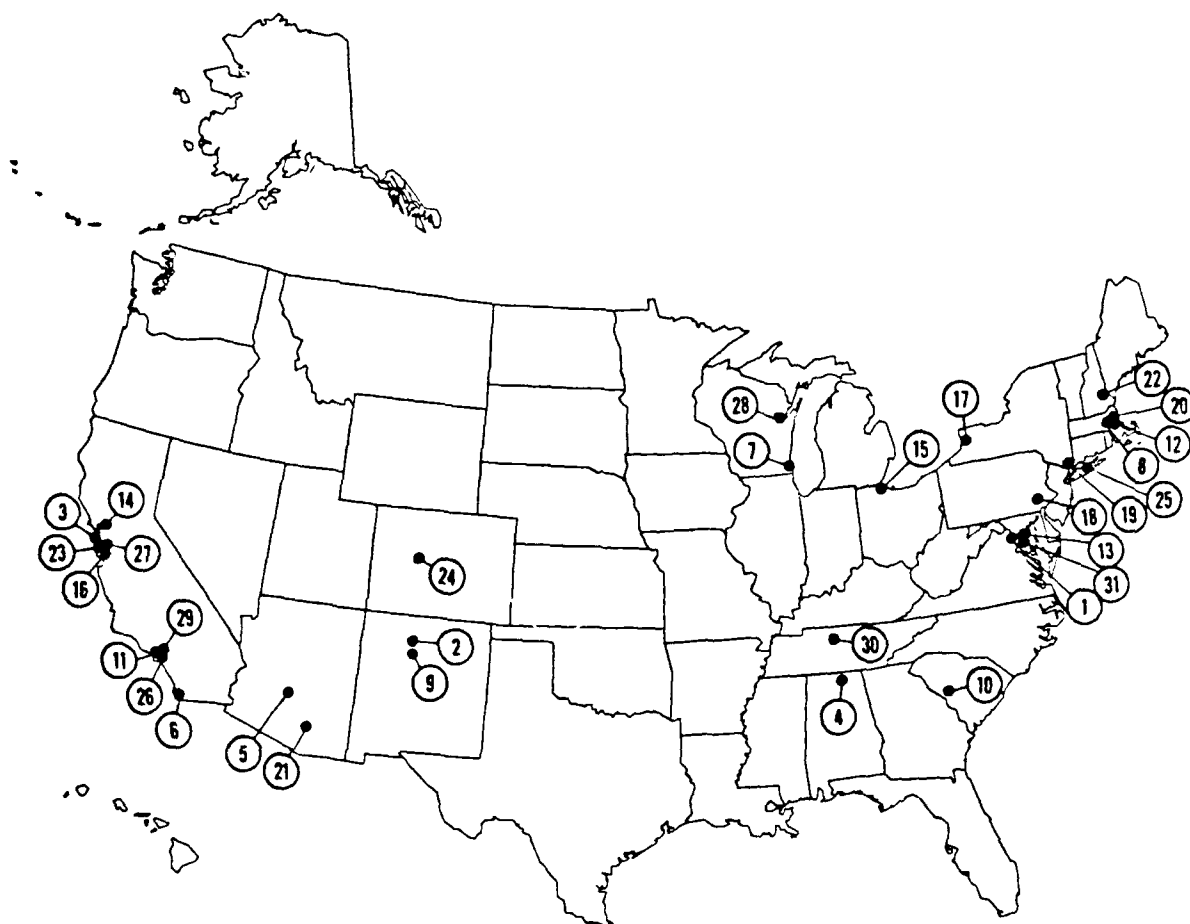
**Friday, March 13, 1992**

**California Institute of Technology  
Braun Laboratory  
Conference Room 151**

|                   |                                                                                                                                                                                                                                                                        |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>8:00 a.m.</b>  | <b>Breakfast</b><br><br>Chandler Hall Cafeteria                                                                                                                                                                                                                        |
| <b>9:00 a.m.</b>  | <b>Case Studies of Efforts to Improve High School Science (continued)</b><br><br><b>V. <u>Southeastern Wisconsin Industry/</u><br/><u>Academic Council on Science Education</u></b><br><br>Robert Fitch<br>Chairman<br>National Industry Council for Science Education |
| <b>10:00 a.m.</b> | <b>Work Session: Recommendations for Future Action - (Small Group Discussions)</b>                                                                                                                                                                                     |
| <b>12:00 p.m.</b> | <b>Barbecue</b>                                                                                                                                                                                                                                                        |
| <b>1:30 p.m.</b>  | <b>Plenary Session</b> <ul style="list-style-type: none"><li>● Reports from Groups</li><li>● Discussion</li></ul><br>Facilitator<br><br>Doug Lapp<br><br>Closing Remarks<br><br>Doug Lapp                                                                              |
| <b>3:00 p.m.</b>  | <b>Adjournment</b>                                                                                                                                                                                                                                                     |



**Working Conference on Precollege Science Education  
for Scientists and Engineers, 1992 Participants**



1. J. Henry Ambrose  
Arlington, VA
2. Fred Begay  
Los Alamos, NM
3. Margaret R. Clark  
San Francisco, CA
4. F. Lee Cook  
Huntsville, AL
5. Karen Conzelman  
Glendale, AZ
6. A. Steven Dahms  
San Diego, CA
7. Robert M. Fitch  
Racine, WI
8. Burton Goodrich  
Maynard, MA
9. Raymond B. Heath  
Albuquerque, NM
10. Michael E. Hodges  
Aiken, SC

11. Susan Kanowith-Klein  
Los Angeles, CA
12. Alan J. Lazarus  
Cambridge, MA
13. Ramon E. Lopez  
Laurel, MD
14. Jan B. Loveless  
Pittsburg, CA
15. Edward Lumsdaine  
Toledo, OH
16. Ellen P. Metzger  
San Jose, CA
17. Robert C. Najjar  
Tonawanda, NY
18. Gregory E. Reaves  
West Point, PA
19. Theodore D. Schultz  
Yorktown Heights, NY
20. Michael B. Silevitch  
Boston, MA

21. Alan F. Smith  
Tuscon, AZ
22. Otis J. Sproul  
Durham, NH
23. Bess Stephens  
Palo Alto, CA
24. George Stranahan  
Woody Creek, CO
25. Karl J. Swyler  
Upton, NY
26. Mare Taagepera  
Irvine, CA
27. Hector Timourian  
Livermore, CA
28. David Turriff  
Green Bay, WI
29. Bruce Tsurutani  
Pasadena, CA
30. Carolyn Ruth A. Williams  
Nashville, TN
31. Vera Zdravkovich  
Largo, MD

**National Science Resources Center  
Working Conference  
on Precollege Science Education  
for Scientists and Engineers  
March 7-13, 1992**

**PARTICIPANTS**

**J. Henry Ambrose**  
*Director, External Affairs*  
Bell Atlantic Corporation  
Arlington, VA

**Fred Begay**  
*Staff Physicist*  
Los Alamos National Laboratory  
Los Alamos, NM

**Margaret R. Clark**  
*Academic Coordinator*  
Science and Health Education Partnership  
Professor, Cancer Research Institute  
University of California  
San Francisco, CA

**F. Lee Cook**  
*Director, Institute for Science Education*  
Associate Dean of Science  
University of Alabama  
Huntsville, AL

**Karen Conzelman**  
*Faculty*  
Department of Biology  
Glendale Community College  
Glendale, AZ

**A. Steven Dahms**  
*Professor of Chemistry*  
San Diego State University  
San Diego, CA

**Robert M. Fitch**  
*Chairman, pro tem*  
National Industry Council for Science Education  
Racine, WI

**Burton Goodrich**  
*Program Manager*  
Engineers Into Education  
Digital Equipment Corporation  
Maynard, MA

**Raymond B. Heath**  
*Science Advisors (SCIAD)*  
*Program Coordinator*  
Sandia National Laboratories  
Albuquerque, NM

**Michael E. Hodges**  
*Fellow Engineer*  
Westinghouse Savannah River Company  
Aiken, SC

**Susan Kanowith-Klein**  
*Director, Science Education Partnership*  
Department of Medicine  
Division of Clinical Immunology and Allergy  
UCLA School of Medicine  
Los Angeles, CA

**Alan J. Lazarus**  
*Senior Research Scientist*  
Massachusetts Institute of Technology  
Cambridge, MA

**Ramon E. Lopez**  
*Scientist/Project Manager*  
Applied Physics Laboratory  
The Johns Hopkins University  
Laurel, MD

**Jan B. Loveless**  
*Manager of Education Affairs*  
The Dow Chemical Company  
Pittsburg, CA

**Edward Lumsdaine**  
*Dean of Engineering*  
The University of Toledo  
Toledo, OH

**Ellen P. Metzger**  
*Associate Professor*  
Department of Geology  
San Jose State University  
San Jose, CA

**Robert C. Najjar**  
*Senior Chemist*  
Union Carbide Industrial Gases Inc.  
Tonawanda, NY

**Gregory E. Reaves**  
*Lead Production Supervisor*  
Merck Pharmaceutical Manufacturing Division  
West Point, PA

**Theodore D. Schultz**  
*Research Staff Member*  
IBM Watson Research Center  
Yorktown Heights, NY

**Michael B. Sillevitch**  
*Professor of Electrical and Computer Engineering*  
Northeastern University  
Boston, MA

**Alan F. Smith**  
*Research Associate*  
Department of Biochemistry  
University of Arizona  
Tucson, AZ

**Otis J. Sproul**  
*Dean, College of Engineering and Physical Sciences*  
University of New Hampshire  
Durham, NH

**George Stranahan**  
*President, Aspen Community School*  
Board Member, Aspen Education Research  
Foundation  
Woody Creek, CO

**Karl J. Swyler**  
*Precollege Educational Program Manager*  
Science Education Center  
Brookhaven National Laboratory  
Upton, NY

**Mare Taagepera**  
*Senior Lecturer*  
Director, Science Education Programs  
School of Physical Sciences  
Department of Chemistry  
University of California  
Irvine, CA

**Hector Timourian**  
*Staff Scientist*  
Science Education Center  
Lawrence Livermore National Laboratory  
Livermore, CA

**David Turriff**  
*President, The Einstein Project, Inc.*  
Director of Toxicology  
Bellin Memorial Hospital  
Green Bay, WI

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**National Science Resources Center  
Working Conference  
on Precollege Science Education  
for Scientists and Engineers  
March 7-13, 1992**

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**National Science Resources Center  
Working Conference  
on Precollege Science Education  
for Scientists and Engineers  
March 7-13, 1992**

**OTHER ATTENDEES**

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National Academy of Sciences  
Washington, DC

**David Schindel**  
*Program Director*  
Teacher Enhancement Program  
Institutes and Recognition Section  
National Science Foundation  
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**Bruce Tsurutani**  
*Senior Scientist*  
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**Peter West**  
*Writer*  
*Education Week*  
Washington, DC

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*Executive Director*

**Sally Shuler**  
*Deputy Director*

**Kit Johnston**  
*Director of Publications*

**Olive Covington**  
*Director of Outreach*

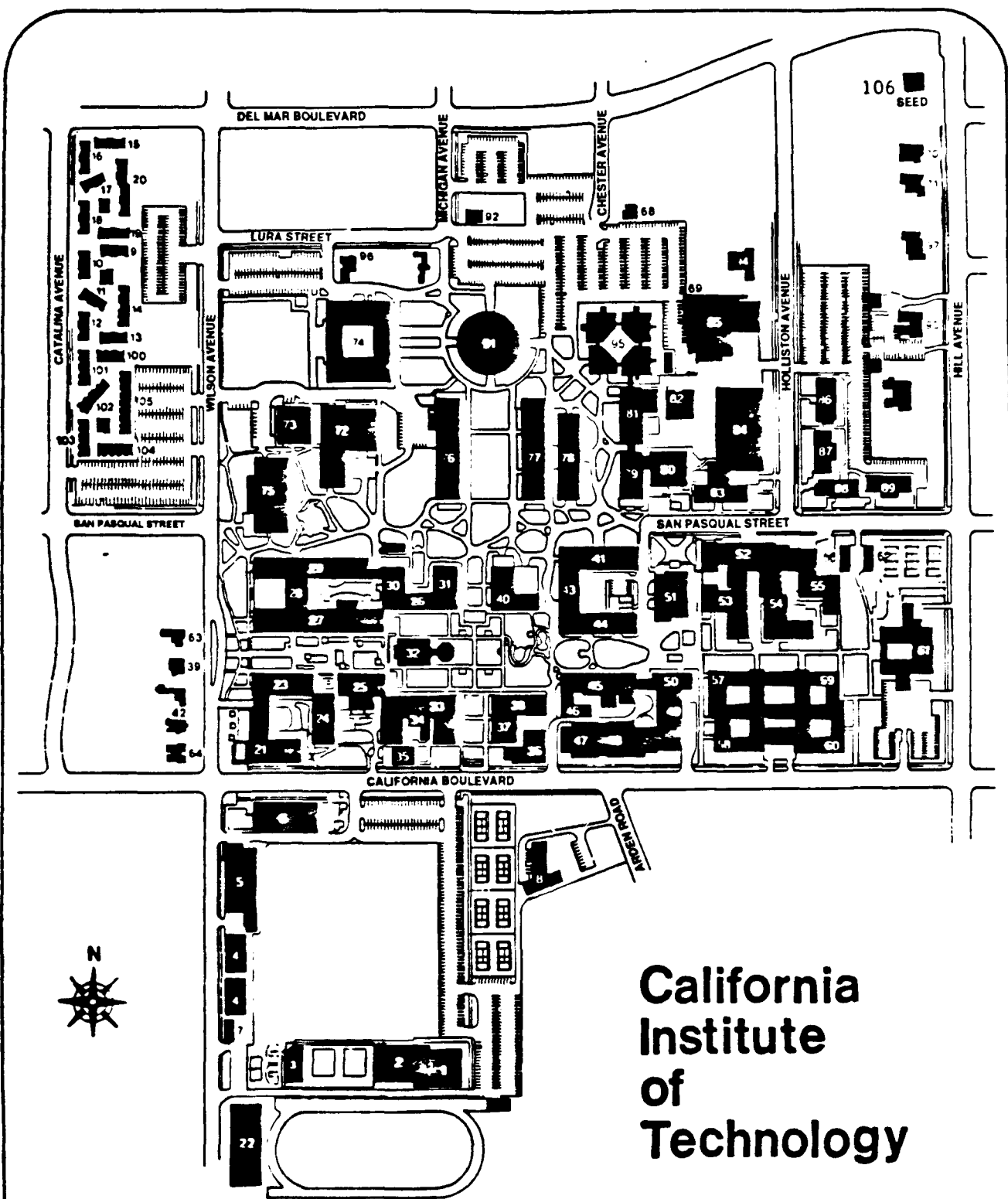
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*Outreach Consultant*

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**Dexter Forbes**  
*Program Assistant*

**Elizabeth Hamilton**  
*Program Assistant*



**PLEASE NOTE:**

- #75 Braun Laboratories
- #27 Kerkhoff Laboratory
- #52 Chandler Dining Hall
- #106 Project SEED House (287 Hill Avenue)





APR 14 1992

OFFICE OF THE DEAN  
UCLA SCHOOL OF MEDICINE  
CENTER FOR THE HEALTH SCIENCES  
10833 LE CONTE AVENUE  
LOS ANGELES, CALIFORNIA 90024-1722

April 2, 1992

Olive Covington  
Director of Outreach  
National Science Resources Center  
Arts & Industries Building, Room 1201  
Smithsonian Institution  
Washington, D.C. 20560

Dear Olive,

Thank you for all your help. I realize my phone call last week couldn't have come at a worse time. You had only one hour left before leaving for the Boston NSTA meeting and finish your presentation and probably x number of other things not mentioned. Still you found time (where?) to fax some of the information I requested and federal express the rest. You are incredible!


The faxed material was immediately useful in adding final (and important) touches to a grant proposal (University of California Presidential Grants for School Improvement) that we submitted this past week from the Science Education Partnership at the UCLA School of Medicine. The Mechling and Oliver booklets for promoting science among elementary school principals are providing me with much-needed background information to speak with principals in my local high school complex (5 elementary schools, 1 middle school, and 1 high school). As mentioned, I'm working with my community's parent-teacher-school administration alliance (The Palisades Complex). We want to establish a dialogue with the principals to find out, first, what's happening with science education at all grade levels and then to determine what can be done to enhance the teaching of science in K -12 classrooms.

The NSRC conference at Cal Tech was great. The handouts, resource materials and information from the presentations are extremely useful. The knowledge gained from the meeting is already shaping the future development of our activities at UCLA. In addition, the meeting was a valuable networking opportunity. However, one of the most critical aspects of the meeting was the way you, Sally and Doug and others from NSRC and Cal Tech made us all feel comfortable and "at home." You created a warm and collegial atmosphere making

it easy for everyone to share information and ideas and support and stimulate one another.

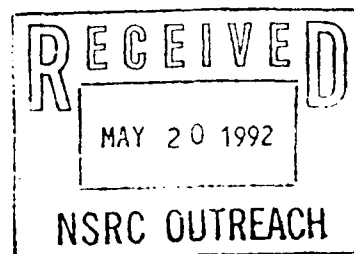
Thank you for so much. I hope the NSTA meeting was successful for you and your colleagues at the NSRC.

All the best,

  
Susan Kanowith-Klein, Ph.D.



Ms. Olive Covington  
Director of Outreach  
National Science Resources Center  
Arts and Industries Building Room 1201  
Smithsonian Institution  
Washington, D.C. 20560



Dear Ms. Covington:

Enclosed you will find a check for \$1,400 for the registration fee for the NSRC Leadership Institute. We are extremely proud that we have been given the opportunity to develop our science programs under your guidance. Our team is anticipating an eventful week at The Smithsonian.

I also wanted to tell you that the week I spent at Cal Tech attending your science workshop was one of the most interesting and rewarding weeks I have ever spent. The agenda was action packed and almost overwhelming, but I got a real sense of what is going on around the country and how our efforts fit with other national and local programs. In a real sense we felt our program was validated by the presentations given during the week.

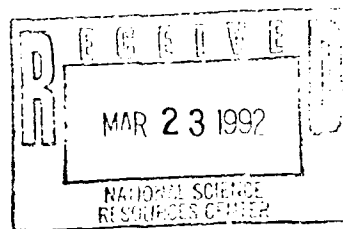
Thank you for your wonderful efforts to stimulate science education.

Sincerely,

David Turriff, Ph.D.  
President

Jet Propulsion Laboratory  
California Institute of Technology  
4800 Oak Grove Drive  
Pasadena, California 91103-8099  
(818) 354 4321

Mail Stop 169-506



**JPL**

Mail Stop 169-506  
Refer to: 3280/BTT:vr

Dr. A. F. Spilhaus  
American Geophysical Union  
2000 Florida Avenue, N.W.  
Washington, D.C. 20009

Dear Fred,

Four SPA members (Al Lazarus, Mike Silevitch, Ray Lopez and myself) attended a seven-day "Working Conference on Precollege Sciences and Education for Scientists and Engineers" held on the Cal Tech campus March 7-13, 1992 (I actually could attend only 3 days). It was sponsored by the National Science Resources Center of the Smithsonian Institute/NAS, and run by Don Lapp. It was a really excellent workshop with talks/discussions led by K-12 educational leaders throughout the country. The program is enclosed.

I have asked Al to take the lead in writing up an article for EOS to summarize the workshop for the AGU members (a very difficult task) and to give them information concerning ongoing programs, and to indicate where they might be of help. I think we have some resources which, if properly tapped, could be a real aid to K-12 education.

Sincerely,

Bruce Tsurutani

Enclosure  
cc: A. Lazarus  
✓ D. Lapp

**NATIONAL SCIENCE RESOURCES CENTER  
WORKING CONFERENCE ON PRECOLLEGE SCIENCE  
EDUCATION FOR SCIENTISTS AND ENGINEERS**

**March 7-13, 1992**

*Conference Summary*

The National Science Resources Center of the Smithsonian Institution and the National Academy of Sciences convened its first working conference on precollege science education at the California Institute of Technology from March 7 to 13, 1992. Designed to help scientists and engineers become involved in the improvement of precollege science education (K-12), this national conference was attended by 30 scientists and engineers from academia, federal research facilities, and private industry.

Over the course of the conference, participants viewed and worked with a variety of innovative science teaching materials, observed "hands-on" science teaching and learning in the elementary school classrooms of the Pasadena Unified School District, and participated in discussions with national leaders in science education reform. Among the presenters were master elementary and secondary school science teachers, leading science educators, experts in cognitive development and the assessment of science learning, and scientists and engineers engaged in school-based projects to improve science education in the nation's schools.

In small group discussions and in plenary sessions, the conference participants explored how scientists and engineers can contribute to the development of high-quality teaching materials; participate in the preservice and in-service education of science teachers; provide assistance and resources to classroom teachers; act as advocates for the establishment of hands-on, inquiry-based science programs in the schools; and work with school districts to create and sustain effective science education programs.

The conference consensus on the concluding day was that "significant change in science education is needed and significant change is possible." It also was agreed that this significant change is possible only if the scientific and engineering communities become involved in alliances. These alliances should have as their goal the effective collaboration of teachers, scientists, and engineers to bring about systemic reforms in science education. It also was agreed that because scientists and engineers must take the lead in bringing about this collaboration, more scientists and engineers need to become engaged in these efforts.

The following recommendations emerged from the conference discussions:

- The development of a new generation of inquiry-based science curriculum materials for middle schools and high schools is critically needed.
- Science curriculum materials of high quality can be produced most effectively through the collaborative efforts of teachers and scientists.

- Groups developing science curriculum materials need to strike a balance between science content and development of scientific reasoning skills.
- Scientists and engineers can play a critical role in providing in-service education programs of high quality for science teachers.
- Scientists and engineers also must become involved in improving the preservice education of future science teachers, because "they will teach the way they were taught."
- Because the assessment of science learning is complex and cannot be accomplished solely through multiple-choice tests, alternative forms of assessment are needed, and they must address higher order thinking skills.
- The development of national standards for K-12 science education is an important task that will require the active participation of the science and engineering community.
- One-shot voluntary efforts by scientists and engineers to assist science teachers in the schools do not often bring about sustained change in science education.
- Any science education improvement project that intends to have a long-term effect must include provisions for encouraging long-term institutionalization of change by the participating school districts.
- To achieve significant reform, science education improvement projects must also pay careful attention to issues of scale and multiplier effects, in order to reach significant numbers of science teachers.
- In all science education improvement efforts, it is essential to build a local base of political support that includes teachers, scientists, parents, and local business and industry.
- The most significant science education improvement efforts are those that are designed to achieve systemic reforms in the educational system, and scientists and engineers should look for opportunities to become involved in such systemic reform efforts.

After assessing the success of this first working conference, the National Science Resources Center plans to continue its efforts to encourage the involvement of scientists and engineers in K-12 science education by holding three additional working conferences over the next three years. In addition, the NSRC is developing a network to share information and provide technical assistance to scientists, engineers, and science educators who are actively working to improve K-12 science education. These activities are a part of the National Elementary Science Leadership Initiative, a four-year NSRC project that is being funded by the National Science Foundation, the U.S. Department of Education, Digital Equipment Corp., Dow Chemical Co., and Hewlett Packard Co.

## **APPENDIX F**

### **NETWORKING AND TECHNICAL ASSISTANCE INFORMATION**

# NSRC Newsletter

■ National Science Resources Center

Smithsonian Institution • National Academy of Sciences

Fall 1991 Vol. 4, No. 2

## NSRC to Launch New National Elementary Science Leadership Initiative

A heightened sense of urgency about the need for science education reform in the United States has resulted in the launching of a major new National Science Resources Center (NSRC) program, the National Elementary Science Leadership Initiative (NESLI).

This multifaceted program, which significantly increases the NSRC's leadership development and technical assistance efforts, is being supported by the National Science Foundation (NSF), the U.S. Department of Educa-

tion, the Dow Chemical Company Foundation, Digital Equipment Corporation, and Hewlett-Packard Company.

"There have been broad-based discussions about the need for educational reforms during the past 10 years, and now national educational goals have been established by the governors and President Bush. Both make our initiative very timely," explained Doug Lapp, executive director of the NSRC.

Over the next four years, NESLI

will engage both educators and scientists across the country in a concerted and sustained effort to improve the teaching of science in the nation's elementary schools. Through the initiative, the NSRC will:

- sponsor a series of leadership institutes to develop a talent pool of educators and scientists who can act as agents of change, leading science education reform efforts in their school districts;

(continued on pg. 4)

## NSRC Holds Annual Elementary Science Leadership Institute

Teams representing 16 school districts in 13 states participated in the NSRC's third annual Elementary Science Leadership Institute held this year during the week of July 8-12.

While the weather alternately sized and poured, the 75 participants worked in the cool underground rooms of the S. Dillon Ripley Center of the Smithsonian Institution with some of the best hands-on science curriculum materials and the most gifted educators in the country. The goal: to develop comprehensive plans to improve the elementary science program in their school districts.

Together, teams participated in workshops and discussions on:

- hands-on science curriculum materials appropriate for grades one through six;
- support systems for supplying hands-on science materials to elementary school teachers;
- inservice education programs to prepare elementary teachers to teach hands-on science;
- interdisciplinary approaches for integrating science instruction with other curricula;



(Photo by Dane Penland)

- assessment methods for evaluating student performance that are consistent with the goals of a hands-on elementary science program; and
- public relations strategies for building administrative and community support for hands-on elementary science programs.

Each school district team included a science curriculum specialist, a master teacher, an administrator, and a scientist from a local university or corporation.

(continued on pg. 5)

### 1992 Leadership Institute Participants

Due to growing demand, the NSRC will hold two Elementary Science Leadership Institutes in 1992 in Washington, D.C. The dates are:

**June 22-26 and July 20-24**

To request a brochure and an application, please fill out and return the form on page 5.



## New Science and Technology for Children *Elementary Science Units Available*

Following the spring 1991 publication of *Plant Growth and Development* (grade 3), *Electric Circuits* (grade 4), and *Microworlds* (grades 5 and 6), the STC project staff and Carolina Biological Supply Company will soon make available three additional

units: *The Life Cycle of Butterflies* (grade 2); *Magnets and Motors* (grade 6); and *Experiments with Plants* (grade 6).

Coming in the spring of 1992 will be *Food Chemistry* (grade 5) and *It's about Time* (grade 6). And two new

units—*Weather and Me* (grade 1) and *Sounds* (grade 3)—are being field-tested this fall.

*Weather and Me* is the first STC unit for grade 1 to be field-tested. It introduces students to the concept of weather and how it relates to their everyday world—from the clothes they wear to the weather forecast. Students learn to read a thermometer, estimate wind speed and direction, make and use a simple rain gauge, and reorganize cloud patterns.

*Sounds* challenges students to investigate what sound is and how it behaves. The unit activities highlight the easily observed characteristics of sound: pitch and loudness. Students build and experiment with a variety of sound producers, including a working model of the vocal chords, learning first hand how humans produce sound. Students then discover how sound is received by building a model of the human ear drum.

In the spring of 1992, *Comparing and Measuring* (grade 1), *Chemical Tests* (grade 3), and *Ecosystems* (grade 5) will be field-tested at schools across the country. Many are in school districts that have sent teams to the NSRC Leadership Institutes. (See article about the 1991 Institute on page 1.)

Destined for field testing in the fall of 1992 are two additional units: *Floating and Sinking* (grade 4) and *Animal Behavior* (also grade 4). These are currently being trial-taught in District of Columbia-area public schools.

In addition to developing and field-testing STC units, the NSRC is working with Carolina Biological Supply to present workshops to teachers on STC units. STC workshops will be held at the regional meetings of the National Science Teachers Association in Vancouver, British Columbia; Reno, Nevada; and New Orleans, Louisiana. STC workshops also will be presented at the NSTA National Convention in Boston, March 26-29, 1992.

For information about the STC materials, contact David Middendorf, Carolina Biological Supply Company, 2700 York Road, Burlington, NC 27215; (919) 584-0381.



Watering can rain helps these children learn to use rain gauges in an activity from the *Weather and Me* unit. (Photo by Dane Penland)

| Science and Technology for Children:<br>Sequence of Units and Publication Dates |                                                                                |                                                                                                  |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Grade                                                                           | Life and<br>Earth Science                                                      | Physical Science<br>and Technology                                                               |
| 1                                                                               | <i>Organisms</i> (Fall 93)<br><i>Weather and Me</i> (Fall 92)                  | <i>Comparing and Measuring</i><br>(Spring 93)<br><i>Observing and Classifying</i><br>(Spring 94) |
| 2                                                                               | <i>Life Cycle of Butterflies</i> (Fall 91)<br><i>Soils</i> (Spring 1994)       | <i>Balancing and Weighing</i> (Fall 93)<br><i>Changes</i> (Fall 94)                              |
| 3                                                                               | <i>Plant Growth and Development</i><br>(Spring 91)<br><i>Rocks</i> (Fall 94)   | <i>Chemical Tests</i> (Spring 93)<br><i>Sounds</i> (Fall 92)                                     |
| 4                                                                               | <i>Ourselves</i> (Fall 94)<br><i>Animal Behavior</i> (Fall 93)                 | <i>Floating and Sinking</i> (Fall 93)<br><i>Electric Circuits</i> (Spring 91)                    |
| 5/6                                                                             | <i>Microworlds</i> (Spring 91)<br><i>Ecosystems</i> (Spring 93)                | <i>Food Chemistry</i> (Spring 92)<br><i>Structures</i> (Spring 94)                               |
| 6                                                                               | <i>Experiments with Plants</i> (Fall 91)<br><i>It's about Time</i> (Spring 92) | <i>Machines and Inventions</i><br>(Fall 94)<br><i>Magnets and Motors</i> (Fall 91)               |

## Science for All Americans: Beyond Themes

Science for All Americans, a report produced by the American Association for the Advancement of Science's Project 2061, consists of a set of recommendations on what all high school graduates should know about science, mathematics, and technology. One of the twelve chapters of recommendations identifies some common themes that cut across many different scientific disciplines. As a result of a growing recognition in recent years of the need to make the study of science less compartmentalized and more unified, the 2061 themes frequently have been used as the basis for the development of science curriculum frameworks. Although this may be a good way to organize the high school science curriculum, the use of abstract themes is less appropriate at the elementary school level. The article reprinted below from the Spring 1991 "2061 Today" newsletter examines this issue further.

There has been a lot of response to the themes described in *Science for All Americans*, such as systems, models,

scale, constancy, and patterns of change. These cross-cutting themes are outside the content of any particular field of science. For example, the idea of a system as a unified whole in which each part is understandable only in relation to other parts could apply to everything from ancient civilization to the earth itself. Common themes were recommended enthusiastically as essential for student understanding by the many scientists who contributed to SFAA, and have been endorsed by scientists, educators, and other reviewers since then.

The common themes chapter is, however, only one among twelve chapters of recommendations in SFAA. Such themes are important for making sense of the pictures that science draws of how the world works, but we didn't intend them to be more important than ideas in any of the other chapters. Themes will likely be a component in any curriculum design, but they are not necessarily a good base for overall organization.

(continued on pg. 6)

## Presidential Awards for Excellence in Science and Mathematics Teaching

In October, the elementary and secondary school recipients of the 1991 Presidential Awards for Excellence in Science and Mathematics Teaching had a whirlwind week of award activities around Washington, D.C., and on the National Mall, including a reception, co-hosted by the NSRC, at the National Air and Space Museum. NSRC Executive Director Doug Lapp delivered the welcoming remarks for the reception, and the NSRC presented a copy of *Science for Children: Resources for Teachers* to each of the 108 elementary school teacher recipients.

It is never too soon to think about next year's awards, particularly since nominations will be due in mid-March. Elementary school teachers may be nominated by colleagues, administrators, students, or parents. Eligible teachers are those who teach science and/or mathematics at least half-time in a self-contained setting or as a specialist in a public or private school in a state or one of the eligible jurisdictions (Washington, D.C., Puerto Rico, the Department of Defense Dependents Schools, and the U.S. territories as a group). Teachers on approved leave in 1991-1992 qualify if they fulfilled the requirements in 1990-1991. At least five years of teaching experience, with responsibility for science and/or mathematics, also is required.

The above requirements also apply to secondary school teacher nominees, with the following exceptions: secondary teachers are defined as teachers of science or mathematics in public or private middle/junior or senior high schools in states or one of the eligible jurisdictions. Also, computer science classes count as mathematics courses, if the school gives mathematics credit for them.

The address for requesting and sending nomination forms for either elementary or secondary teachers is "Secondary PAESMT," c/o NSTA—Special Projects, 5112 Berwyn Rd., 3rd Floor, College Park, MD 20740.

## NSRC Network Exchange

University of Minnesota radio station KUOM has completed production of a public radio series entitled "Science Lives: Women and Minorities in the Sciences." This series consists of 13 half-hour programs addressing the shortage of women and minorities in the sciences, and provides role models for women and minorities who are considering careers in technology and the sciences.

The first two programs are documentaries that set forth this national problem, and the creative solutions being tried. The remaining eleven are audio portraits of newsworthy women and minority scientists and their work. Interviewees include Nobel Prize winner Gertrude Elion, future astronaut Mae Jemison, and U.S. Secretary of Health and Human Services, Louis Sullivan.

Public radio stations will be broadcasting the series through December of 1991. Contact your local public radio station for broadcast times in your area or contact the University of Minnesota for information on how to obtain a cassette of the program, a 20-page brochure, and discussion questions: University of Minnesota Media Distribution, 420 Delaware Street SE, Box 734, Mayo Memorial Building, Minneapolis, MN 55455; (612) 624-7906.

\*\*\*\*\*

*The Scientist* reports on a new *Journal of High School Science Research* that features student accounts of their experiments, book reviews, and helpful tips for both students and teachers on subjects such as databases and computer-assisted science projects.

The journal's faculty advisor, Mike Farmer, says the journal gives budding scientists a chance to build up their resumes and nonscience majors an opportunity to sharpen their communications skills. For more information, write to Applied Educational Technology, P.O. Box 193, Tigerville, S.C. 29688.

## LEADERSHIP INITIATIVE

(continued from pg. 1)

- provide specialized technical assistance to school districts working to improve their elementary science programs;
- disseminate information on effective hands-on, inquiry-based science teaching resources and sources of expertise to people working to improve elementary science education; and
- stimulate policy and program changes that will lead to the improvement of science education in school districts throughout the country.

"Central to this comprehensive initiative is the development of informed leadership and the identification of national resources that can be made available to respond to local needs," said Lapp. "One of our major goals is to make school districts and communities aware of the high-quality hands-on materials produced by national elementary science materials development projects."

NESLI also will build on current efforts to examine the goals of the entire precollege science curriculum, such as "Project 2061" of the American Association for the Advancement of Science, the "Scope, Sequence, and Coordination Project" of the National Science Teachers Association, and the National Research Council initiative to coordinate the development of K-12 science standards.

In addition, through NESLI, the NSRC will make a special effort to address the needs of projects operating with assistance from the Eisenhower Grants Program, and projects supported by the NSF Statewide Systemic Initiatives Program.

In the leadership development area, NESLI will make it possible for the NSRC to sponsor Elementary Science Leadership Institutes for action teams from 120 school districts (30 districts each year for four years). These institutes will prepare action teams to develop and implement plans for the improvement of elementary science education in their school districts. The NSRC also will sponsor working conferences for scientists and engineers -- 30 each year -- to prepare

them for leadership roles in the improvement of precollege science education. (See pg. 1 for a related story on the 1991 Leadership Institute and pg. 4 for a related story on the working conferences for scientists and engineers.)

In the area of technical assistance, NESLI will provide educators and scientists with the expert advice and assistance they need to launch and sustain science teaching reforms in their districts. Technical assistance activities will include publishing and disseminating a guide to the implementation of an effective elementary science program; disseminating information about effective elementary science teaching resources and sources of expertise; organizing presentations at meetings of national, state, and local organizations to promote elementary

science curriculum reform; and creating a national network of people actively engaged in activities to reform science teaching in elementary schools.

"Through the NSRC's unique ties to both the National Academy of Sciences and the Smithsonian Institution, the National Elementary Science Leadership Initiative has the capacity to marshal the energies of leaders in science, education, and industry across the country, enabling them to act as catalysts for change," noted David Sheetz, former vice president for research at Dow Chemical Company and chairman of the NSRC Advisory Board. "We believe that this project promises to bring about significant reforms in the teaching of science in the nation's elementary schools." ❖

## NSRC to Sponsor Conferences for Scientists and Engineers

In the spring of 1992, the National Science Resources Center will sponsor the first of a series of four annual working conferences for scientists and engineers who wish to become involved in the improvement of science education in elementary and secondary schools. During each conference, scientists and engineers from universities, government laboratories, and private industry will spend a week with master elementary and secondary school teachers, participating in hands-on science workshops and discussions that are designed to acquaint them with the needs of and new developments in precollege science education.

Conference attendees will examine how scientists and engineers can:

- contribute to the development of high-quality teaching materials and resources;
- participate in the inservice and preservice education of teachers;
- help to provide appropriate assistance and resources to classroom teachers;
- act as advocates for the establishment of hands-on, inquiry-based elementary and secondary school science programs in their local communities; and
- work with school districts to create and sustain effective science programs in the schools.

The NSRC plans to develop a network of scientists and engineers who are working to improve the teaching of science in the schools. Scientists and engineers who would like additional information about this program should contact Olive Covington, Director of Outreach, at the NSRC.

### Position Available

The National Science Resources Center is seeking an Elementary Science Materials Development Specialist. Duties include working as part of a team to develop units of study, design apparatus, write and revise teacher and student guides, and lead teacher workshops.

Position requires a B.A. in the physical, life, or earth sciences or the equivalent, three years of public school teaching, preferably with some elementary school experience, knowledge of hands-on science materials, and demonstrated writing ability. Interested parties should send their resumes to: STC Project Director, National Science Resources Center, Rm. 1201, Arts and Industries Bldg., Smithsonian Institution, Washington, D.C. 20560.

### THIRD ANNUAL INSTITUTE

(continued from pg. 1)

NSRC Executive Director Doug Lapp asked participants to take a moment to view the need for hands-on science programs from the perspective of the child, who, as a matter of course from the day of birth, behaves like a scientist. If allowed to continue to explore the world through hands-on investigations, and if encouraged to ask questions and pursue answers, a child will develop positive attitudes toward science and scientific habits of mind. In the process, children will also acquire critical thinking and problem-solving skills that will last a lifetime, Lapp stressed.

Engaging in workshops featuring a variety of hands-on science curriculum materials, institute participants had an opportunity to experience what children could experience in the classroom if provided with hands-on science materials and instruction. Curriculum materials featured in these workshops included Educational De-

velopment Center's "Insights" program, the Lawrence Hall of Science's FOSS and GEMS programs, and the NSRC's Science and Technology for Children program.

The institute participants also interacted with presenters in discussions of some of the major elements of a successful hands-on science elementary program. For example, teams were intrigued by Hubert Dyasi's and Karen Worth's suggestions to teachers on how to "ask the right questions at the right time." Dyasi is the director of the City College of New York's Workshop Center, and Worth is the principal investigator for the EDC's "Insights" project.

An afternoon spent touring and learning about the hands-on Science Materials Center of the Fairfax County Public School system excited many participants. The staff at the center outlined how they manage the delivery and recycling of hands-on science materials to approximately 2,000 Fairfax elementary school teachers.

Other major discussion topics included "Elements of an Effective Teacher Education Program," presented by Worth and Susan Sprague, Director of Science and Social Sciences for the Mesa, Arizona Public Schools; "Assessment Methods for Evaluating Student Learning," led by Doug Reynolds, chief of the New York State Bureau of Science Education, and Sabra Price of Lesley College; and "Funding Sources for Elementary Science Program Improvement," presented by Susan Snyder of the National Science Foundation and Allen Schmieder of the U.S. Department of Education.

Many hours were devoted to "team work," as the teams planned how to bring about reforms in the elementary science programs of their school districts. They were assisted in this task by representatives from school systems across the country with exemplary elementary science programs.

Evening speakers included Maxine Singer, president of the Carnegie Institution of Washington, who spoke about the importance of elementary science in stimulating an interest in science in all students, especially women and minorities. Also, Samuel H. Fuller, vice president for corporate research, Digital Equipment Corporation, shared concerns about the need to prepare today's students for the scientific work place of tomorrow. In addition, Shirley McBay, president, Quality Education for Minorities (QEM) Network, outlined for participants the challenges of leadership.

The NSRC outreach staff will continue to maintain contact with and provide technical assistance to the 1991 Leadership Institute participants as they move forward with their plans to improve the science programs in their school districts. Also planned is a reunion of 1989, 1990, and 1991 Leadership Institute participants to be held in Boston on March 28, 1992, in conjunction with the annual meeting of the National Science Teachers Association.

For more information about future Leadership Institutes, contact Olive Covington, Director of Outreach, at the NSRC. ♦

#### 1992 Elementary Science Leadership Institutes

Please send a Leadership Institute brochure and an application to:

Name: \_\_\_\_\_

Title: \_\_\_\_\_

School or Institution: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City/State/ZIP: \_\_\_\_\_

Telephone: \_\_\_\_\_

School System (if applicable): \_\_\_\_\_

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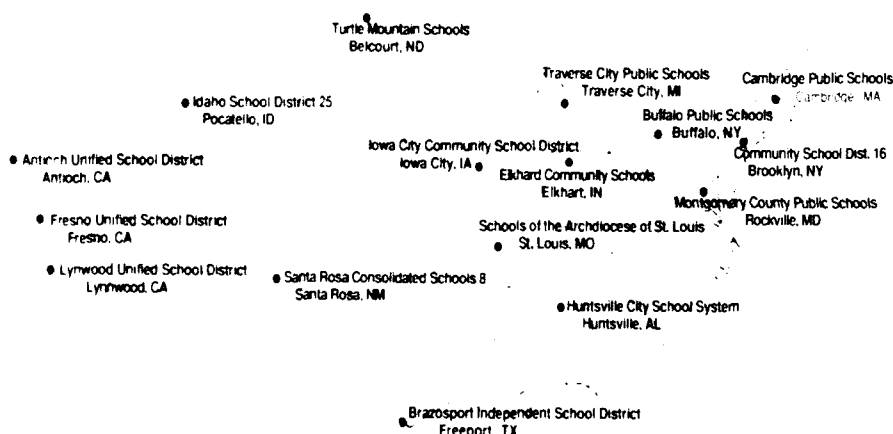
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## School Districts Participating in the 1991 National Science Resources Center Elementary Science Leadership Institute



## THEMES

(continued from pg. 3)

Themes will make sense to students only after they accumulate a wealth of experience in which the themes can be seen. There may be limited usefulness, therefore, in designing a fourth-grade unit of study on "systems" or "patterns of change" in the abstract—although that might be a good idea in the 11th grade, when students know enough biology, physics, [and so on] to appreciate the utility of those themes in making sense of science. ♦

The National Science Resources Center is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary teaching resources, develops and disseminates curriculum materials, and sponsors outreach activities, specifically in the areas of leadership development and technical assistance, to help school districts develop and sustain hands-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, DC.

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Resources Center

# NSRC Newsletter

■ National Science Resources Center

Smithsonian Institution • National Academy of Sciences

Spring 1992 Vol. 5, No. 1

## NSRC Convenes Conference for Scientists and Engineers on Science Education

The National Science Resources Center of the Smithsonian Institution and the National Academy of Sciences convened its first working conference on precollege science education at the California Institute of Technology from March 7 to 13, 1992. Designed to help scientists and engineers become involved in the improvement of precollege science education (K-12), this national conference was attended by 28 scientists and engineers from academia, federal research facilities, and private industry.

**"At the elementary-school level, in many school districts, the teaching of science has virtually disappeared," said Doug Lapp, the NSRC's executive director.**

Over the course of the conference, participants viewed and worked with a variety of innovative science teaching materials, observed "hands-on" science teaching and learning in the elementary school classrooms of the Pasadena Unified School District, and participated in discussions with national leaders in science education reform. Among the presenters were master elementary and secondary school science teachers, leading science educators, experts in cognitive development and the assessment of science learning, and scientists and engineers engaged in school-based projects to improve science education in the nation's schools.

In small group discussions and in plenary sessions, the conference participants explored how scientists and engineers can contribute to the development of high-quality teaching materials; participate in the preservice and in-service education of science teachers; provide assistance and resources to classroom teachers; act as advocates for the establishment of

(continued on pg. 5)



Working conference participants Ellen Metzger and Ray Heath investigate the FOSS program materials with Linda DeLucchi from the Lawrence Hall of Science. (Photo by Robert Paz)

## Elementary Science Education in the United States: How Scientists Can Help

*Excerpted below is an article from the December 1991 issue of Current Biology by Bruce M. Alberts, Professor of Biochemistry, University of California at San Francisco, member of the NSRC Advisory Board, and keynote speaker for the NSRC's first working conference for scientists and engineers.*

During my early school years, the Second World War was underway, and—as for many others—my view of the world was dominated by this event. Life was relatively simple.... Only much later did I come to realize how complex the world really is: all too often, good, well-intentioned peo-

ple establish rules and institutions that end up doing bad things to the people they are trying to help. So it is with science education in our schools.

Scientists are puzzle solvers, and the natural world is full of weird and wonderful phenomena that need explaining, providing us with an unending series of challenges. To me, learning to do science is not much different than learning common sense: the tools of modern science are much more sophisticated than the tools of everyday life, but the same type of puzzle-solving—involving postulating hypotheses that are readily tested by experience—is important for success in almost any human endeavour.

I view early science education as education in an important aspect of common sense, that is, an effective solving of the problems that are posed to everyone by the natural world. Viewed in this way, science is clearly seen to be a core subject.... Professor John A. Moore of the University of California, Riverside, argues that science education should comprise at

(continued on pg. 4)



(Photo by Herb Shoebridge)

## STC Update

The recent NSTA Convention in Boston was a great forum for the NSRC's Science and Technology for Children project. It drew record numbers of elementary school teachers interested in hands-on science materials.

At NSTA, STC and Carolina Biological Supply Co. (CBS) offered 10 workshops on 10 units. STC unit developers Wendy Binder and Debby Deal also presented a session on integrating language arts and math with science instruction. STC units offer many opportunities for integrating language skills, including whole class and team discussions and notebooks of science results. STC units also offer bibliographies of children science books, many of which are available through CBS.

New unit development and production continues to move ahead. Soon to be available from CBS are *The Life Cycle of Butterflies* (grade 2) and *Experiments with Plants* (6). Available now are *Plant Growth and Development* (3), *Electric Circuits* (4), *Microworlds* (5), and *Magnets and Motors* (6). Projected for availability in the fall of 1992 are *Food Chemistry* (5) and *Time* (6).

Meanwhile, the following units have been field-tested: *Weather and Me* (grade 1) and *Sounds* (3). And *Comparing and Measuring* (1), *Chemical Tests* (3), *Ecosystems* (5), *Animal Studies* (4), and *Floating and Sinking* (4) are being field tested now or will be in the fall. School systems that participate in field testing are often those that have participated in the NSRC's Elementary Science Leadership Institutes.

David Middendorf and Richard Franks of CBS spent much of the year traveling, and responding to teacher training requests. Now they're back home in Burlington, trying to keep up with the demand for STC units. If you are interested in ordering STC units, call or write David Middendorf at CBS, 2700 York Rd., Burlington, NC 27215. (919) 584-0381.

## The STC Project's Unit Development Experience: Part 1

As teachers and administrators around the country review the possibilities for teaching science in a hands-on fashion at the elementary school level, the NSRC's Science and Technology for Children (STC) project is often asked about procedures for developing hands-on science teaching units.

In the STC project's experience, hands-on science units that undergo a rigorous development and review process hold the greatest promise of being effective with children in diverse classroom settings and with a variety of learning styles.

The STC unit development process begins when an STC curriculum developer researches a unit topic using the resources of the Smithsonian Institution, the National Academy of Sciences, and master elementary teachers from across the country. After obtaining a range of ideas for exploring the topic in depth over eight or more weeks of classroom time, the developer trial teaches the unit in a public school in the District of Columbia metropolitan area. The children's receptivity to the ideas, their experiences, the age-appropriateness of the skills and concepts of the unit, and the ease with which the unit can be taught and managed in the classroom point the way toward revision.

In preparing for the extensive field testing that follows trial-teaching, the developer writes a first draft of a teacher's guide and student activity book. This draft is edited, illustrated,

reviewed, re-edited if necessary, and then printed. The kits containing equipment and apparatus for each unit are assembled by the publisher. The guides, student books, and kits are then sent to classroom teachers in a number of school systems nationwide, where each unit is taught by at least 12 teachers after some initial training by on-site coordinators.

Field test data is then collected and evaluated by the STC project evaluators—Sabra Price and George Hein of Lesley College. Teachers and students are interviewed, and student work is reviewed.

Concurrent with field testing, each unit is reviewed by an advisory panel of prominent scientists and educators who assess units for scientific accuracy and pedagogical validity.

Final revisions prior to commercial publication, sale, and distribution by the publisher are based on field-testing data and comments received from the advisory panel. If necessary, further review by outside consultants and experts is requested until the unit is deemed ready for release.

The STC research and development process is a lengthy and arduous one, but feedback from the field—from schools and teachers now using the unit—indicate that the extensiveness of the research and development process is worth the effort.

*In the next NSRC Newsletter—how assessment is handled in STC units.*



Fourth and fifth graders at Bailey's Elementary School (Fairfax Co., VA) sort and identify bones in an activity from *Animal Studies*. (Photo by Dane Penland)

## UCSF and San Francisco Schools Launch "City Science" Partnership

What happens when a university-affiliated scientist decides to take an active role in the science education program of the local school district? In San Francisco, one scientist's interest in his children's education stimulated the formation of a productive partnership.

Not too long ago, Dr. Bruce Alberts, professor of biochemistry and biophysics at the University of California at San Francisco (UCSF), had four school-aged children in the house. His wife was active in PTA, and both parents were concerned about the quality of their children's science education. This concern eventually led to the creation of the City Science Program.

Jointly sponsored by the Science and Health Education Partnership at UCSF and the San Francisco Unified School District (SFUSD), City Science now serves over 3,000 children districtwide, introducing hands-on science curriculum to grades K through 5 and providing teacher education sessions and materials support. Next year, 6,000 children will be served.

### Program began with one-on-one partnerships

In a recent interview, City Science co-director Jan Tuomi observed that it is "common" for scientists to get involved in science education by having children in school. In the case of City Science, UCSF scientists, most of whom had children in school, began working with SFUSD high-school teachers on a one-on-one basis.

The volunteer scientists and teachers soon realized that working together at the high-school level wasn't enough—that science education improvement was needed in the earlier grades, too. The university expanded its involvement by donating surplus lab equipment and scientific supplies to middle as well as high school classrooms, providing interactive summer workshops, and assisting in the design of hands-on curriculum for the middle school grades.

"An important key to the success of this program's development has been the teacher/scientist collaboration that evolved and that has resulted in an approach to science education improve-

ment that is appropriate for the students' level," noted Tuomi.

This approach recently helped Tuomi and Alberts obtain for City Science a \$2.7 million, 4-year grant from the National Science Foundation to extend the partnership to the elementary grades.

### City Science at the elementary schools

When elementary school teachers sign up to participate in City Science, they commit themselves to attend one

ences with these units, and to examine effective integration activities, teachers also attend all-day meetings one Saturday each month.

As of the spring term, 100 teachers were enrolled in the program. By 1995, 24 hands-on science curriculum units from a variety of curriculum development projects (four at each grade level) will have been introduced into the elementary schools of the San Francisco Unified School District.

### Teachers are seen as key to success

As a former teacher and science resources coordinator for SFUSD, Tuomi feels strongly that the teachers are "the key to the long-term success of the program. When they feel empowered with the knowledge of science, they feel they can teach science."

Involvement of UCSF scientists is also crucial, Tuomi says, because they help to demystify science for the teachers. The teachers come to see the scientists as "ordinary people with special skills." And when teachers have an opportunity to visit the scientists in their labs and see them practicing science, they become more aware of what is possible in their own science classes.

### Scientists learn, too

The scientists who participate in City Science have learned a lot about education, Tuomi says. "They have learned which learning techniques and activities are successful for children—techniques and activities that are foreign to the competitive lecture/test environment of the university."

It hasn't been easy for some of the scientists to alter what they thought or assumed about children's cognitive development. But Tuomi credits them for succeeding in this and also for recognizing how hard teachers work and how little support they receive.

City Science is creating community advocates for better science programs—both scientists and teachers, Tuomi says. And when scientists and teachers work together as colleagues for change, change can happen.

\* \* \*



Jan Tuomi of City Science works with a student in the SFUSD.  
(UCSF photo by Mikkel Aaland)

month-long in-service education session every summer for four years. There they participate in workshops on new curriculum units packaged as a "kit" for their grade level. Six master teachers—and two scientists working with each of them—use the same cooperative learning methods that the teachers will be expected to use when they return to their classrooms to teach the units.

Following the summer program, teachers return to their schools to teach the units to their students. To give teachers an opportunity to discuss with each other their classroom experi-



## HOW SCIENTISTS CAN HELP

(continued from pg. 1)

least 20% of each year's curriculum for grades K through 12. By science education, he means hands-on experience in puzzle-solving that builds on the natural curiosity of children and helps them to make better sense of their world.... Yet, it has been estimated that less than 1% of the elementary students in the U.S. receive as much as 2 hours per week of hands-on science instruction in our schools.

There are many reasons for the inadequacy of...science education.... First, in science courses at many levels, what is easy to test...perverts what we require our students to learn. The result is an emphasis on 'science names' that is inappropriate at the college level, and completely misguided at lower levels.... Second, most elementary teachers have an aversion for the type of science that they were taught in school, and they know almost nothing about science as a puzzle-solving exercise. Third, designing interesting, age-appropriate science investigations for young people is an art that requires both an understanding of science and an understanding of how students learn. Very few professional curriculum developers are able to do this effectively. It is unreasonable to expect individual teachers to be able to design such science lessons by themselves. Fourth, doing meaningful hands-on science investigations in the classroom often requires special materials that are unavailable to an elementary teacher. In the U.S., obtaining the funds needed to correct this situation depends on having an effective 'science lobby' in each school district...but in most districts, there is no effective lobby for science....

I believe that scientists have a crucial role to play in precollege science education reforms. But it is not easy to know how or where to begin. The natural response of a scientist who wants to help improve science teaching in our schools is to concentrate at the high school level.... But high school teachers presently face tremendous constraints, including the need to teach for state and national tests that stress a broad (and necessarily superficial) coverage of science, 45-minute periods that are too short for meaningful laboratory sessions, and the difficulty of reaching students who have already acquired a strong distaste for what was called science in their early school years. Many of us with experience in school systems have therefore come to the conclusion that the major revolution called for in science education is best accomplished 'bottom up,' by starting in what at first seemed to us to be a very alien world—the elementary school.

The advantages of focusing on accomplishing systemic change in the science taught in elementary schools include the fact that many of our best teachers are found in these schools, and they teach curious children who are still eager to learn. Moreover, they have one class for the en-

tire day, so that they can schedule the time required for a meaningful hands-on science experience. Of crucial importance, outstanding science units have been developed for teaching hands-on science at the elementary level (by the NSRC, the Lawrence Hall of Science, and others). A further advantage is that the curriculum taught is not subject to the types of constraints that presently stifle revolutionary change at the higher levels. Science process, rather than science facts, can therefore be the predominant focus.

At these lower levels, 'hands-on' experience with meaningful science explorations should be a major part of a science curriculum that stresses the...material taught should be interesting. If we can accomplish this, students will arrive at secondary school with enthusiasm rather than fear for science, and their positive experiences are likely to force the development of a similarly interesting science curriculum in the middle and high schools.

Among experts, there seems to be little or no dispute about what should be done to improve science education at the elementary level. What we lack are the will and the resources required to do it. In the U.S., school policies are determined by local school districts, most of which lack both the expertise and the impetus for attempting any major change. A revolution in science teaching is likely to require a coalition of outstanding elementary teachers (as a district 'leadership team') with a small team of local scientists. By acting as catalysts, these scientists can make a major difference to the type of science that is taught in our children. Their major role is to create a 'science lobby' to help and promote the real change agents in the system, who are the outstanding teachers. We are indeed fortunate that, despite the many problems in our schools, most school districts still contain such large numbers of talented, dedicated teachers. It is these people, and the children whom they teach,

who badly need our support.

The scientists with the above role can come from either industry or academia, but in either case...[t]hey will need a master teacher to introduce them to both the pedagogy and the content of elementary science teaching...The scientists will also need guidance on how to work with teachers and with school districts, and how to help in obtaining the supplementary funding needed. Most of all, these scientists will need to be firmly connected to a network of other scientists like themselves, as well as to science educators on whom they can call for help and advice.

With the encouragement of the National Academy of Sciences, an experimental two-day mini-course with all of the above goals [was recently] offered by the American Society of Cell Biology. [T]his mini-course was intended to be the first of a series...held in connection with the national meetings of major American scientific societies. The aim is to develop a large cadre of informed and interested scientists, and to network them together with leadership from the National Academy of Sciences. Within the next year, the Academy also hopes to establish a set of local working groups—each composed of outstanding teachers, scientists, and science educators—designed to support and inform others in the network, as well as to work in their local area on science education reform. One of the tasks for these groups [will] be to identify outstanding model curricula, teacher in-service programs, textbooks and laboratory exercises, and then to find effective ways of encouraging their widespread adoption. A second crucial responsibility [will] be to help create a strong focus at every major university on the education and support of precollege science teachers. If these teachers are welcomed on all of our campuses—as an integral part of the science community—many more of our students can be expected to become interested in exploring such careers.

### NSRC Network

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## WORKING CONFERENCE

*(continued from pg. 1)*

hands-on, inquiry-based science programs in the schools; and work with school districts to create and sustain effective science education programs.

The conference consensus on the concluding day was that "significant change in science education is needed and significant change is possible." It also was agreed that this significant change is possible only if the scientific and engineering communities become involved in alliances with school districts. These alliances should have as their goal the effective collaboration of teachers, scientists, and engineers to bring about systemic reforms in science education. It also was agreed that because scientists and engineers must take the lead in bringing about this collaboration, more scientists and engineers need to become engaged in these efforts.

The following recommendations emerged from the conference discussions:

- The development of a new generation of inquiry-based science curriculum materials for middle schools and high schools is critically needed.
- Science curriculum materials of high quality can be produced most effectively through the collaborative efforts of teachers and scientists.
- Groups developing science curriculum materials need to strike a balance between science content and development of scientific reasoning skills.
- Scientists and engineers can play a critical role in providing in-service education programs of high quality for science teachers.
- Scientists and engineers also must become involved in improving the preservice education of future science teachers, because "they will teach the way they were taught."
- Because the assessment of science learning is complex and cannot be accomplished solely through multiple-choice tests, alternative forms of assessment are needed, and they must address higher order thinking skills.



Margaret Clark and Carolyn Williams work together to build a magnetic compass during the working conference.  
(Photo by Robert Paz)

- The development of national standards for K-12 science education is an important task that will require the active participation of the science and engineering community.
- One-shot voluntary efforts by scientists and engineers to assist science teachers in the schools do not often bring about sustained change in science education.
- Any science education improvement project that intends to have a long-term effect must include provisions for encouraging long-term institutionalizing of change by the participating school districts.
- To achieve significant reform, science education improvement projects must also pay careful attention to issues of scale and multiplier effects, in order to reach significant numbers of science teachers.
- In all science education improvement efforts, it is essential to build a local base of political support that includes teachers, scientists, parents, and local business and industry.
- The most significant science education improvement efforts are those designed to achieve systemic reforms in the educational system, and scientists and engineers should look for opportunities to become involved in such systemic reform efforts.

After assessing the success of this first working conference, the NSRC

plans to continue its efforts to encourage the involvement of scientists and engineers in K-12 science education by holding three additional working conferences over the next three years. In addition, the NSRC is developing a network to share information and provide technical assistance to scientists, engineers, and science educators who are actively working to improve K-12 science education. These activities are a part of the National Elementary Science Leadership Initiative, a four-year NSRC project that is being funded by the National Science Foundation, the U.S. Department of Education, Digital Equipment Corp., Dow Chemical Co., and Hewlett Packard Co.

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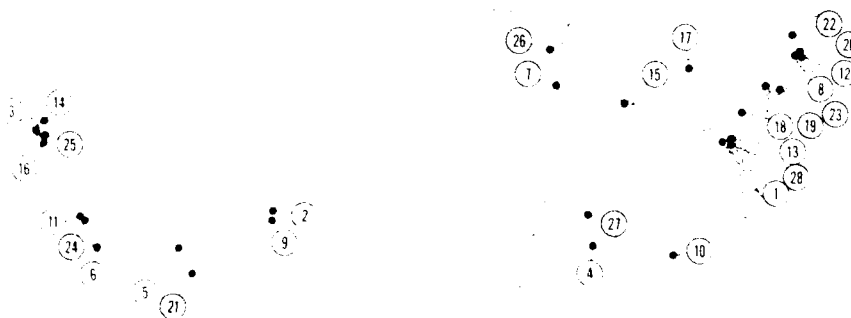
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## Participants in the 1992 Working Conference on Precollege Science Education for Scientists and Engineers



- |                                           |                                             |                                                 |                                               |
|-------------------------------------------|---------------------------------------------|-------------------------------------------------|-----------------------------------------------|
| 1. J. Henry Ambrose<br>Arlington, VA      | 8. Burton Goodrich<br>Maynard, MA           | 15. Edward Lumsdaine<br>Toledo, OH              | 22. Otis J. Sproul<br>Durham, NH              |
| 2. Fred Begay<br>Los Alamos, NM           | 9. Raymond B. Heath<br>Albuquerque, NM      | 16. Ellen P. Metzger<br>San Jose, CA            | 23. Karl J. Swyler<br>Upton, NY               |
| 3. Margaret R. Clark<br>San Francisco, CA | 10. Michael E. Hodges<br>Aiken, SC          | 17. Robert C. Najjar<br>Tonawanda, NY           | 24. Mare Taagepera<br>Irvine, CA              |
| 4. F. Lee Cook<br>Huntsville, AL          | 11. Susan Kanowith-Klein<br>Los Angeles, CA | 18. Gregory E. Reaves<br>West Point, PA         | 25. Hector Timourian<br>Livermore, CA         |
| 5. Karen Conzelman<br>Glendale, AZ        | 12. Alan J. Lazarus<br>Cambridge, MA        | 19. Theodore D. Schultz<br>Yorktown Heights, NY | 26. David Turriff<br>Green Bay, WI            |
| 6. A. Steven Dahms<br>San Diego, CA       | 13. Ramon E. Lopez<br>Laurel, MD            | 20. Michael B. Silevitch<br>Boston, MA          | 27. Carolyn Ruth A. Williams<br>Nashville, TN |
| 7. Robert M. Fitch<br>Racine, WI          | 14. Jan B. Loveless<br>Pittsburg, CA        | 21. Alan F. Smith<br>Tucson, AZ                 | 28. Vera Zdravkovich<br>Largo, MD             |

NATIONAL SCIENCE RESOURCES CENTER  
SMITHSONIAN INSTITUTION - NATIONAL ACADEMY OF SCIENCES

ARTS AND INDUSTRIES BUILDING, ROOM 1201  
SMITHSONIAN INSTITUTION WASHINGTON, DC 20560

March 9, 1992

(202) 357-2555

Dear NSRC Leadership Institute Alumni:

We are looking forward to seeing you at the 1992 National Science Teachers Association (NSTA) National Convention in Boston. The Reunion of the 1989, 1990 and 1991 Leadership Institute Participants will take place on Friday, March 27, from 1:00 p.m. - 3:00 p.m. in the Mariner Room of the Back-Bay Hilton Hotel. At this meeting you will have the opportunity to share the kind of year it's been for science in your district, and to hear about the NSRC's latest activities and plans. Most of all, it will be a glorious opportunity for you to meet one another and for all of us at the NSRC to see you again. We are looking forward to this with great anticipation because we believe that the future of good science teaching in our schools rests in large measure with you. In addition to the reunion, we invite you to join us for 3 other sessions that will take place on Friday and Saturday.

On Friday morning from 9:30 a.m. - 11:30 a.m., also in the Mariner Room, there will be a discussion of the new NSRC National Elementary Science Leadership Initiative. We would like some of you to share your leadership institute experience with people from new districts who are interested in attending. At this session we will also describe our plans for future institutes.

The Association of Science Materials Centers (ASMC) will meet on Saturday, March 28 from 8:15 a.m. - 12:30 p.m. in Room 105 of the Hynes Convention Center. At this meeting Sabra Price will do a special one-hour presentation on performance-based assessment. In addition, you will have the opportunity to meet people from around the country who have, or would like to have, centers in their school districts. They will exchange ideas and resources, and discuss issues related to the operation and management of science materials centers.

On Saturday afternoon from 2:00 p.m. - 5:00 p.m. we extend you a special invitation to join staff of the NSRC and the NETWORK, in Room 105 of the Hynes Convention Center, to play an exciting game that simulates the process of making change in a school district. Players represent cross-district teams responsible for introducing, implementing, and sustaining a new program. Their efforts meet with success or failure depending upon their appropriateness, timeliness, and just plain luck. I think you will find the game, "Making Change for School Improvement," to be a valuable learning experience.

Joe Griffith and the STC staff will be conducting workshops on old and new STC units on Friday, Saturday and Sunday (see enclosed schedule). I am sure you will find all of these sessions informative, productive and fun.

For those of you who cannot make it to Boston, we would appreciate an update on how you and science are doing.

We are off to Pasadena, March 7 - 13, where we will be conducting the first of four annual Working Conferences on Precollege Science Education for Scientists and Engineers at the California Institute of Technology (see enclosed brochure). We are also frantically getting ready for two 1992 Leadership Institutes. Can you imagine that? The deadline for applications is April 1 and we expect an avalanche. How exciting.

Hope you and your team members are managing to stay in touch, and that you will let us hear from you from time to time. We'd especially like to know about changes of address.

Doug, Sally, Joe and the entire NSRC staff send best regards.

Take care,

Olin

Olive Covington  
Director of Outreach

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**Elementary Science  
Leadership Institute Reunion**

*Friday, March 27, 1992*

Mariner Room  
Back Bay Hilton  
Boston, Massachusetts

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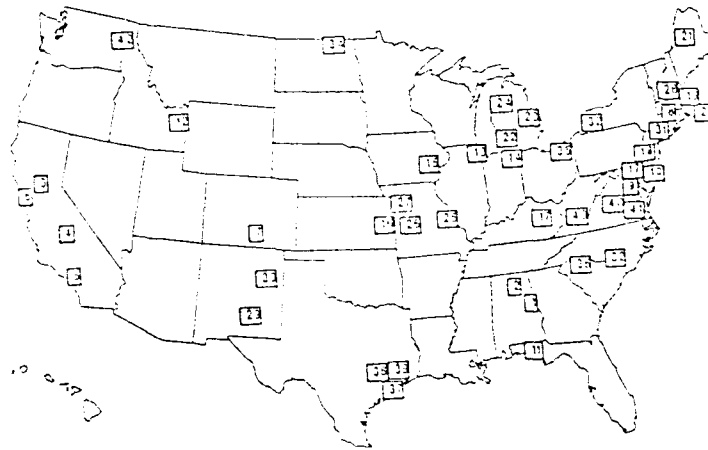
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**NSRC**

**National Science Resources Center**

SMITHSONIAN INSTITUTION-NATIONAL ACADEMY OF SCIENCES

## 1989-1991 Participating School Districts



1. Anniston City Schools, Anniston, AL
2. Huntsville City School System, Huntsville, AL
3. Antioch Unified School District, Antioch, CA
4. Fresno Unified School District, Fresno, CA
5. Lynwood Unified School District, Lynwood, CA
6. San Francisco Unified School District, San Francisco, CA
7. Alamosa School District RE-11J, Alamosa, CO
8. Hartford Public Schools, Hartford, CT
9. District of Columbia Public Schools, Washington, DC
10. Delaware Science Alliance
11. Bay District Schools, Panama City, FL
12. Idaho School District 25, Pocatello, ID
13. Chicago Public Schools, Chicago, IL
14. Elkhart Community Schools, Elkhart, IN
15. Iowa City Community School District, Iowa City, IA
16. Unified School District 500, Kansas City, KS
17. Fayette County Public Schools, Lexington, KY
18. Montgomery County Public Schools, Rockville, MD
19. Cambridge Public Schools, Cambridge, MA
20. Fall River Public Schools, Fall River, MA
21. Maine School Administrative District 58, Kingfield, ME
22. Battle Creek Area Schools, Battle Creek, MI
23. Midland Public Schools, Midland, MI
24. Traverse City Public Schools, Traverse City, MI
25. Schools of the Archdiocese of St. Louis, St. Louis, MO
26. The School District of Kansas City, Kansas City, MO
27. St. Joseph School District, St. Joseph, MO
28. Nashua School District, Nashua, NH
29. Las Cruces Public Schools District 2, Las Cruces, NM
30. Santa Rosa Consolidated Schools No. 8, Santa Rosa, NM
31. Community School District 16, Brooklyn, NY
32. Buffalo Public Schools, Buffalo, NY
33. Charlotte Mecklenburg Schools, Charlotte, NC
34. Turtle Mountain Schools, Belcourt, ND
35. Cleveland Public Schools, Cleveland, OH
36. Greenville County School District, Greenville, SC
37. Brazosport Independent School District, Freeport, TX
38. Fort Bend Independent School District, Sugar Land, TX
39. Spring Independent School District, Houston, TX
40. Albemarle County Public Schools, Charlottesville, VA
41. Henrico County Public Schools, Richmond, VA
42. Spokane Public School District 81, Spokane, WA
43. Mercer County Schools, Princeton, WV

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## National Science Resources Center

Elementary Science Leadership Institute Reunion  
Friday, March 27, 1992  
Mariner Room, Back Bay Hilton  
1:30 p.m. - 3:00 p.m.

### Opening Remarks

Doug Lapp  
*NSRC Executive Director*

### Introduction of Alumni and Guests

*Moderator:*  
Pam Tickle ('89)  
*Staff Developer*, Office of Instruction  
Fall River, Massachusetts Public Schools

### Leadership Institute Alumni Progress Reports

*Moderators:*  
Melanie Barron ('91)  
*Coordinator of Science*  
Cambridge, Massachusetts Public Schools

Sandra Spooner ('91)  
*Assistant Superintendent for Curriculum and Instruction*  
Cambridge, Massachusetts Public Schools

### Science and Technology for Children (STC): Field Testing STC Units

Joe Griffith  
*STC Project Director*

### NSRC: Future Plans

Sally Shuler  
*NSRC Deputy Director*

### Closing Remarks

Olive Covington  
*NSRC Director of Outreach*



# NSRC

National Science Resources Center

The National Science Resources Center (NSRC) is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, D.C.

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**Association of Science Materials Center  
Fourth Annual Meeting**

*March 28, 1992*

Room 105  
Hynes Convention Center  
Boston, Massachusetts

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**NSRC**

**National Science Resources Center**

SMITHSONIAN INSTITUTION—NATIONAL ACADEMY OF SCIENCES

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**National Science Resources Center  
Association of Science Materials Centers**



SMITHSONIAN INSTITUTION



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The Association of Science Materials Centers (ASMC) is a technical assistance activity of the National Science Resources Center (NSRC) Outreach Program. ASMC is a nationwide organization of school districts with centers that supply teachers with the equipment, materials, and training they need to teach a hands-on elementary science program. Representatives from school districts, education service centers, universities, and museums meet annually to share information and resources that can be used to establish effective hands-on science programs for children and teachers. The annual meeting of ASMC is held each year in conjunction with the national convention of the National Science Teachers Association.

The National Science Resources Center (NSRC) was established in 1985 by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. Located on the Mall in Washington, D.C., the NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs.

**National Science Resources Center  
Smithsonian Institution-National Academy of Sciences  
Arts & Industries Building, Room 1201  
Washington, DC 20560  
(202) 357-2555**

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## Association of Science Materials Centers

Annual Meeting  
March 28, 1992  
8:15 a.m. - 12:00 noon

### *Agenda*

- |            |                                                                                                                                                                                                                                          |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8:15 a.m.  | <b>Registration</b>                                                                                                                                                                                                                      |
| 8:30 a.m.  | <b>Welcoming Remarks</b> <ul style="list-style-type: none"><li>■ Susan Sprague<br/>Director, Science and Social Science<br/>Mesa, Arizona, Public Schools</li></ul>                                                                      |
| 8:40 a.m.  | <b>Performance-based Assessment for<br/>Inquiry Center Science Teachers</b> <ul style="list-style-type: none"><li>■ Sabra Price<br/>Program and Evaluation Research Group<br/>Lesley College<br/>Cambridge, Massachusetts</li></ul>      |
| 9:30 a.m.  | <b>Small Group Discussion</b>                                                                                                                                                                                                            |
| 10:30 a.m. | <b>Overview of Chemical Education for<br/>Public Understanding Program (CEPUP)</b> <ul style="list-style-type: none"><li>■ Herb Thier<br/>Director, CEPUP<br/>Lawrence Hall of Science</li></ul>                                         |
| 11:30 a.m. | <b>Small Group Discussion</b>                                                                                                                                                                                                            |
| 12:00 Noon | <b>Plenary Session and Closing Remarks</b> <ul style="list-style-type: none"><li>■ Reports from Groups</li><li>■ Closing Remarks:<br/>Susan Sprague<br/>Sally Shuler<br/>Deputy Director<br/>National Science Resources Center</li></ul> |

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and the Institute of Medicine

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# ASMC

Association of Science Materials Center  
Fourth Annual Meeting

*National Science Teachers Association  
National Convention*

*Boston, Massachusetts  
March 28, 1992*

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 National Science Resources Center  
SMITHSONIAN INSTITUTION—NATIONAL ACADEMY OF SCIENCES



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**Association of Science Materials Centers  
Fourth Annual Meeting  
March 28, 1992**

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The annual meeting of ASMC is held each year in conjunction with the national convention of the National Science Teachers Association. This year's ASMC program will include a discussion of performance-based assessment strategies for hands-on elementary science programs, led by Sabra Price of the Program and Evaluation Research Group of Lesley College in Cambridge, Massachusetts.

*Plan now to attend  
the Fourth Annual Meeting of the  
Association of Science Materials Centers*

*NSTA National Convention  
Saturday, March 28, 1992  
8:15 a.m. to 12:30 p.m.  
Room 105  
Hynes Convention Center  
Boston, Massachusetts*

*For reservations, call Charmane Beverly at the NSRC  
(202) 357-2555  
by Tuesday, March 24, 1992*



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ASMC is a networking activity of the National Science Resources Center (NSRC) Outreach Program. The **National Science Resources Center** is operated by the Smithsonian Institution and the National Academy of Sciences to improve the teaching of science in the nation's schools. The NSRC collects and disseminates information about exemplary science teaching resources, develops innovative science curriculum materials, and sponsors outreach activities to help school districts develop and sustain hands-on science programs. The NSRC is located in the Arts and Industries Building of the Smithsonian Institution in Washington, D.C.

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Association of Science Materials Centers  
ASMC  
Fourth Annual Meeting

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